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ABSTRACT

This module on concrete reinforcing is one of a series of modules designed to teach basic skills necessary for entry-level employment in this field. This module contains three instructional units that cover the following topics: (1) concrete reinforcing materials; (2) concrete reinforcing tools; and (3) concrete reinforcing basic skills. Each instructional unit follows a standard format that includes some or all of these eight basic components: performance objectives, suggested activities for the instructor, information sheets, assignment sheets, job sheets, transparency masters, tests, and answers to tests and assignment sheets. All of the unit components focus on measurable and observable learning outcomes and are designed for use in more than one lesson or class period. Each unit contains illustrations. (KC)

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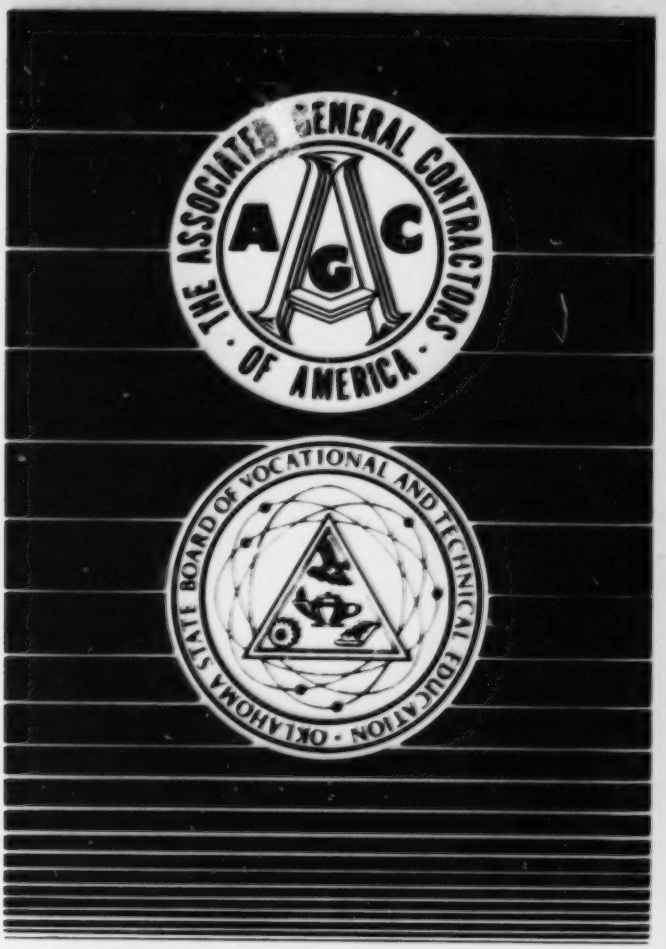
The Associated General Contractors of America



INTRODUCTION TO CONCRETE REINFORCING

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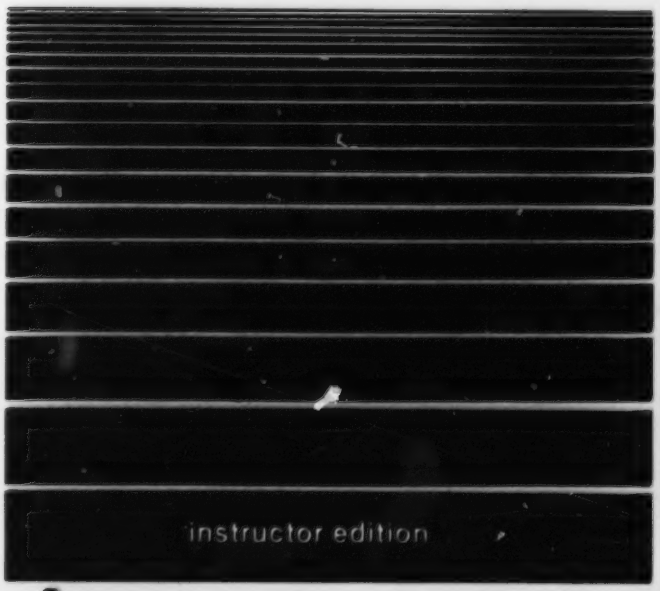

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INTRODUCTION TO CONCRETE REINFORCING
COMPETENCY PROFILE

Student: _____ Soc. Sec. No: ___ ___ _____
Last First MI

_____ Grade 9 10 11 12 Adult _____
PROGRAM SCHOOL

_____ _____ _____
INSTRUCTOR SCHOOL ADDRESS PHONE

_____ _____ _____
STUDENT'S HOME ADDRESS DATE OF BIRTH PHONE

_____

_____ _____ _____
STUDENT'S EMPLOYER ADDRESS PHONE

_____

_____ _____
CONTACT IN CASE OF EMERGENCY PHONE

_____
ADDRESS

_____
OR

_____ _____
ADDRESS PHONE

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ON-JOB TRAINING/WORK EXPERIENCE

DURATION OF EMPLOYMENT	JOB TITLE	EMPLOYER	SUPERVISOR'S NAME	ADDRESS OF EMPLOYER	PHONE

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SPECIFIC JOB COMPETENCIES

Directions: Evaluate the trainee using the rating scale below and check the appropriate number to indicate the degree of competency achieved. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each of the numbers focus on level of student performance for each of the tasks listed below. The written test score line is provided for optional teacher use. It may not be applicable in all cases. "NA" is an appropriate entry in such instances.

Rating Scale:
4 — Skilled — can perform independently with no additional training.
3 — Moderately Skilled — has performed independently during training program, limited additional training may be required.
2 — Limited Practice — has practiced during training program, additional training is required to develop skill.
1 — Exposure Only — general information provided with no practice time, close supervision needed and additional training required.
0 — No Exposure — no information or practice provided during training program, complete training required.

4 3 2 1 0
☐☐☐☐☐ *Concrete Reinforcing Materials*
☐☐☐☐☐ 1. _____

WRITTEN TEST SCORE _____

4 3 2 1 0
☐☐☐☐☐ *Concrete Reinforcing Tools*
☐☐☐☐☐ 1. _____

WRITTEN TEST SCORE _____

4 3 2 1 0
☐☐☐☐☐ *Concrete Reinforcing Basic Skills*
☐☐☐☐☐ 1. Install #4 reinforcing bars at 12" on center for a footing 6" x 6" using single tie
☐☐☐☐☐ 2. Install #4 reinforcing bars at 12" on center in a wall 4" x 8" using wall tie
☐☐☐☐☐ 3. Lay and tie welded wire fabric
☐☐☐☐☐ 4. _____

WRITTEN TEST SCORE _____

Use of This Document

This document can be used to record information about the student and the skills mastered by the student. This information is useful in documenting student progress during the training program and to provide information about the student's qualifications to potential employers and for entry into advanced training programs. Instructors using AGC-CIMC instructional materials are authorized to reproduce this document as required for use in their training programs.

INTRODUCTION TO CONCRETE REINFORCING

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The Associated General Contractors of America
and
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INTRODUCTION TO CONCRETE REINFORCING

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FOREWORD

In 1985, The Associated General Contractors of American (AGC) met with representatives of the Oklahoma Curriculum and Instructional Materials Center (CIMC) to discuss the possibilities of developing, as a cooperative project, a course of instruction designed for training individuals who choose to seriously explore careers in construction.

This publication is the result of those original discussions and close coordination among general contractors and vocational educators. This series represents a conscious effort to coordinate the practical experience of personnel in the construction industry with the best instructional methods of those in the field of vocational education.

Although this series reflects a systematic approach to instructional materials development and the latest in educational technology innovations, the information in *Introduction to Concrete Reinforcing* should be adapted and modified to coincide with local conditions.

Roy Peters, Jr., Director
Oklahoma State Department of
Vocational and Technical Education

William K. Healy, Chairman
Manpower and Training Committee
The Associated General Contractors
of America

PREFACE

For many years The Associated General Contractors of America (AGC) has recognized the need for providing quality competency-based instructional materials for the construction industry. AGC and the Oklahoma State Department of Vocational and Technical Education have met this challenge by providing nationally recognized curriculum and services since 1972. In 1986 AGC and Oklahoma's Curriculum and Instructional Materials Center (CIMC) determined a significant need for a series that would address training needs of open shop contractors, pre-apprenticeship programs, multi-craft high school programs, technology educational programs, CVET, and cooperative education programs. The Introduction to Construction Series was designed with the flexible training requirements of these groups in mind.

The introduction to Construction Series begins with *Fundamentals of Construction* and progresses to twelve spin-off specialty publications. *Fundamentals of Construction* covers basic knowledge necessary for all individuals in construction. Each specialty area covers basic skills necessary for entry-level employment. Both vocational education and the construction industry offer more advanced courses in each specialty area and should be considered by individuals wishing to establish careers in the industry. Competency profiles (provided in the teacher edition) for the Introduction to Construction Series articulate with several more advanced AGC publications as well as publications developed by the Mid-America Vocational Curriculum Consortium (MAVCC).

Publications in this series include:

- Introduction to Bricklaying
- Introduction to Carpentry
- Introduction to Concrete Masonry
- Introduction to Concrete Reinforcing
- Introduction to Electricity
- Introduction to Plumbing
- Introduction to Heating, Ventilation, and Air Conditioning
- Introduction to Sheet Metal
- Introduction to Roofing
- Introduction to Drywall
- Introduction to Insulation
- Introduction to Welding

Instructional Units

Introduction to Concrete Reinforcing contains three instructional units. A standard format was established in 1970 for development of instructional materials for all Oklahoma vocational teachers. This format includes eight basic components that form a unit of instruction: performance objectives, suggested activities for the teacher, information sheets, assignment sheets, job sheets, transparency masters and supplements, tests, and answers to tests and assignment sheets. Depending on the specific objectives, there may or may not be transparency masters, supplements, assignment sheets, or job sheets, included in the unit of instruction.

All of the unit components "zero in" on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the teacher will help him or her determine the following

- Amount of material that can be covered in each class period
- Skills that must be demonstrated
  - Supplies and equipment needed
  - Amount of practice needed
  - Amount of class time needed for demonstrations
- Supplementary materials, such as pamphlets and filmstrips, that must be ordered
- Resource people to contact

Performance Objectives (white pages)

Each unit of instruction is based on the performance needed for successful employment in an occupational area. Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the performance necessary to reach the unit objective. Since the objectives of the unit provide direction for the teaching/learning process, it is important that teachers and students have a common understanding of the intent of the objectives.

The objectives sheet should be given to students and referred to throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Prepare for each unit by deciding how each objective can best be taught.

The objective sheet may also be used as a quick pretest to determine students' prior knowledge and to determine whether further study or activities are necessary. Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When changes in objectives are made, the teacher should remember to supply the needed information, assignment and/or job sheets, and criterion test items.

Suggested Activities (pink pages)

Suggested activities are included only in teacher materials. The suggested activities pages include an outline of the unit contents and an instructor's guide designed to assist teachers in planning their presentation of the unit. The instructor's guide provides suggestions for delivery and/or presentation during the instructional process. Read the suggested activities

before teaching the units so that supplemental materials can be obtained, audiovisual materials prepared, and outside resources contacted. Duties of the teacher will vary according to the particular unit.

The references that are listed in the suggested activities are ones used in the development of each unit. They may be used by the teacher to supplement her or his knowledge of the subject area or to help students with particular interests or occupational objectives in the area covered.

The suggested activities section of the unit also includes supplements and transparency masters. Each of these components provides information in a special way. Supplements may consist of motivational materials, review or practice materials such as crossword puzzles and self-tests, or charts and reference materials. Supplements are designed to be copied and distributed to individual class members or to the class as a whole. Suggestions for their use are included in the instructor's guide. Transparencies direct the class' attention to the topic of discussion. Transparencies may present new information, or they may reinforce information presented in the information sheet. They are particularly effective when identification or analysis is necessary. Order transparencies from the Curriculum and Instructional Materials Center, or make transparencies and place them in the notebook where they will be immediately available for use.

Information Sheet (green pages)

The information sheet provides "must know" content essential for meeting the cognitive (knowledge level) objectives of the unit. The information is written in a topical-outline form and is keyed to the specific objectives.

Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. The information sheet may also be used for coordination activities and advisory committees.

Students should read the information sheet before the information is discussed in class. Space is provided in margins for students and teachers to add notes that supplement, localize, personalize, or provide motivation for each unit.

Assignment Sheets (brown pages)

Assignment sheets give students a chance at problem solving, self-assessment, and/or practical experience. They assist students in the application of knowledge that are necessary pre-requisites to skill development. Assignment sheets may be given to the student for completion in class or may be used for homework assignments. Answer sheets are provided when appropriate and can be used by the student and/or teacher for checking student progress. The scores of those assignment sheets listed in the specific objectives should be averaged with the unit test score, as the skills addressed in these assignment sheets are considered necessary in meeting the unit objectives.

Job Sheets (blue pages)

Job sheets are another important segment of a unit of instruction. The job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychomotor skill. They describe a step-by-step procedure needed to complete each task or job. Diagrams, photographs, and illustrations are provided to assist students in achieving the skill.

The teacher should demonstrate to students the procedures outlined in each job sheet. Furthermore, the teacher needs to localize the job sheet according to the equipment and supplies available in the local lab or shop situation. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might

reasonably expect from a person who has had this vocational instruction.

Job sheet performance should be evaluated by the instructor and averaged with the unit test score, as the skills addressed in the job sheets are considered necessary in meeting the unit objective.

Tests (white pages)

Tests are included only in teacher materials. The test provides criterion-referenced evaluation of every objective listed in the unit of instruction. It is crucial to note that both paper/pencil and performance objectives must be evaluated.

It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of questions from the units covered may be used for final tests at the end of each term if desired. If objectives have been added, deleted, or modified, be sure to make the changes on the test.

The acceptable response on a unit test, 80 percent in most units, may be raised or lowered to fit the topic or students' ability levels. The percentage applies to the overall score, not to each question. The final unit grade should be obtained by using the paper/pencil score and evaluations of student demonstrations of the desired skills.

Answers to Test and Assignment Sheets (pink pages)

Answers to test and assignment sheets are components designed to assist the teacher in evaluation of student performances.

Page Numbering

Each publication from the Curriculum and Instructional Materials Center (CIMC) is assigned a specific abbreviation. For example, *Introduction to Concrete Reinforcing* has been abbreviated ITCR. The units are then numbered consecutively within each section. An example of a page number is ITCR-1. Since CIMC publications are loose leaf, this system of page numbering was adopted so that pages from different manuals would not get mixed up.

Methods of Disseminating Material

For best results, provide student materials for each student. Student materials contain everything but the test, supplements, answers to assignment sheets, and suggested activities.

Teaching Methods

It is a challenge to keep students motivated. Supplement the objectives by providing the "why," personal experiences, and current information. Prepare for each unit by deciding how each objective can best be taught. Allow students to become involved in preparing and planning.

Competency Profiles

Competency profiles are folders used to document student performance. The profile contains a list of the specific job competencies that a student should achieve prior to leaving the training program. A competency profile master is provided in the instructor edition of each publication. Duplicate the profile and distribute to students as required.

Other AGC Publications: AGC updates curriculum products on a continuing basis. For a free catalog describing other AGC products, call the AGC National office at 1-202-393-2040.

CORRECTIONS AND SUGGESTIONS

The Curriculum and Instructional Materials Center (CIMC) wants to provide vocational instructors and students with materials that are accurate and effective. Although the CIMC strives to maintain the highest standards of development and production, oversights occasionally do occur. If you find any errors in this or other CIMC publications, or have suggestions for improving their usefulness in vocational programs, please notify the CIMC staff. One easy way of pointing out errors is to make a photocopy of the affected page and to indicate the correction on the copy. You can mail the information to the CIMC, where it will be used to correct the publication before the materials are reprinted.

To ensure that the material is updated on a timely basis, it is important that you notify the CIMC of necessary corrections as soon as possible after discovering the error. Do not assume that someone else will notice the error and inform the CIMC; other users may be making the same assumption. Please send corrections and recommendations for improving this publication to the following address:

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Curriculum and Instructional Materials Center
Oklahoma State Department of Vocational and
Technical Education
1500 West Seventh Avenue
Stillwater, Oklahoma 74074

CONCRETE REINFORCING MATERIALS
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to identify the various types of materials used in concrete reinforcing work. .The student will show this ability by completing the unit test with a minimum score of 80 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with reinforcing material to their correct definitions.
2. Select common sizes of welded wire fabric.
3. Identify standard reinforcing bar (rebar) sizes.
4. Match the lines and numbers found on rebars to their identification.
5. Identify types of wire ties used to install rebars.
6. Identify types of rebar supports.
7. Identify types of rebar splices.
8. Name types of reinforcing bars.
9. Identify shapes of reinforcing bars.

CONCRETE REINFORCING MATERIALS
UNIT I

SUGGESTED ACTIVITIES

I. Unit content

A. Objective sheet

B. Suggested activities

C. Supplement #1 — Typical Bar Bends

II. Instructor's guide

A. Review unit and plan presentation.

B. Obtain materials to supplement unit.

1. Manufacturer's catalogs of materials

2. Safety posters

3. Samples of rebars, supports, anchoring devices and rebar splices

C. Introduce unit to students.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives.

F. Provide students with information and assignment sheets.

G. Discuss information and assignment sheets.

1. Use Information Sheet, Section I, to introduce students to the terms and definitions associated with concrete reinforcing materials.

- Show students samples of appropriate terms.

2. Use Information Sheet, Sections II and III, to discuss common sizes of welded wire fabric and rebars.

- Explain to students that welded wire fabric and rebars are reinforcing steel which are embedded in concrete in such a manner that the reinforcement and the concrete act together in resisting forces.

SUGGESTED ACTIVITIES

- Discuss the importance of proper installation of reinforcement and maintaining the proper placement of it in the concrete; also discuss the proper concrete coverage over the reinforcing steel.

- Show students samples of different sizes of welded wire fabric and rebars.

- Discuss where and why these different sizes of reinforcing are used and how the size used depends on the required strength the concrete is designed to carry.

- Explain that all reinforcing must be clean, free from mud, oil, and other nonmetallic coatings that may affect bonding capacity at time concrete is placed.

3. Use Information Sheet, Section IV, to discuss identification of rebars by lines and numbers.

   - Discuss the importance of the ironworker being able to read and verify the identification markings on the rebars.

   - Discuss how important the particular grade is to the design of the concrete members and how these grades are determined by an engineer who will specify the specific grades either in the specifications or on the drawings.

   - Discuss the size of deformed rebars and how an installer may be able to determine the size of the bar by measuring the diameter of the bar if for some reason the tag is missing or the identification marks are not clear. The nominal dimensions of a rebar (not including deformations) are equivalent to those of plain round bars having the same weight per foot as the deformed bar.

   - Have students practice identifying rebars by completing the assignment sheet.

   - Show students actual samples of rebars with identification marks, give each student the opportunity to read these marks.

4. Use Information Sheet, Section V, to discuss types of wire ties used to install rebars.

   - Show students samples of the various types of ties.

   - Demonstrate how to make the various ties, then have students demonstrate how to make them.

SUGGESTED ACTIVITIES

- Discuss where and why the various types of ties may be used.

5. Use Information Sheet, Section VI, to discuss types of rebar supports.
   - Display samples of different types of supports.
   - Give the students the opportunity to look at and handle the various types of supports.
   - Demonstrate the use of the supports and discuss their use.
   - Discuss how the use of the supports is determined by the placement of the reinforcing bars and how the supports determine the amount of concrete coverage on the rebars.
6. Use Information Sheet, Section VII, to discuss types of rebar splices.
   - Display samples of different types of splices.
   - Discuss reasons for making splices.
   - Demonstrate procedures for making splices then have the students demonstrate the procedures.

H. Give test.

I. Critique test and discuss in class.

J. Reteach and retest as necessary.

K. Complete appropriate sections of competency profiles.

III. Unit references

A. Cadweld Rebar Splicing. Supplement to Rebar Splicing Catalog, No. CRS 31249. Cleveland, Ohio: ERICO Products Inc., 1980.

B. Dowel Bar Substitution. DB-SAE Splicer System. Ft. Worth, Texas: Richmond Screw Anchor Co., 1980.

C. Hendrix, Laborn J. "Bud". *Construction Craftsman's Curriculum*, Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1978.

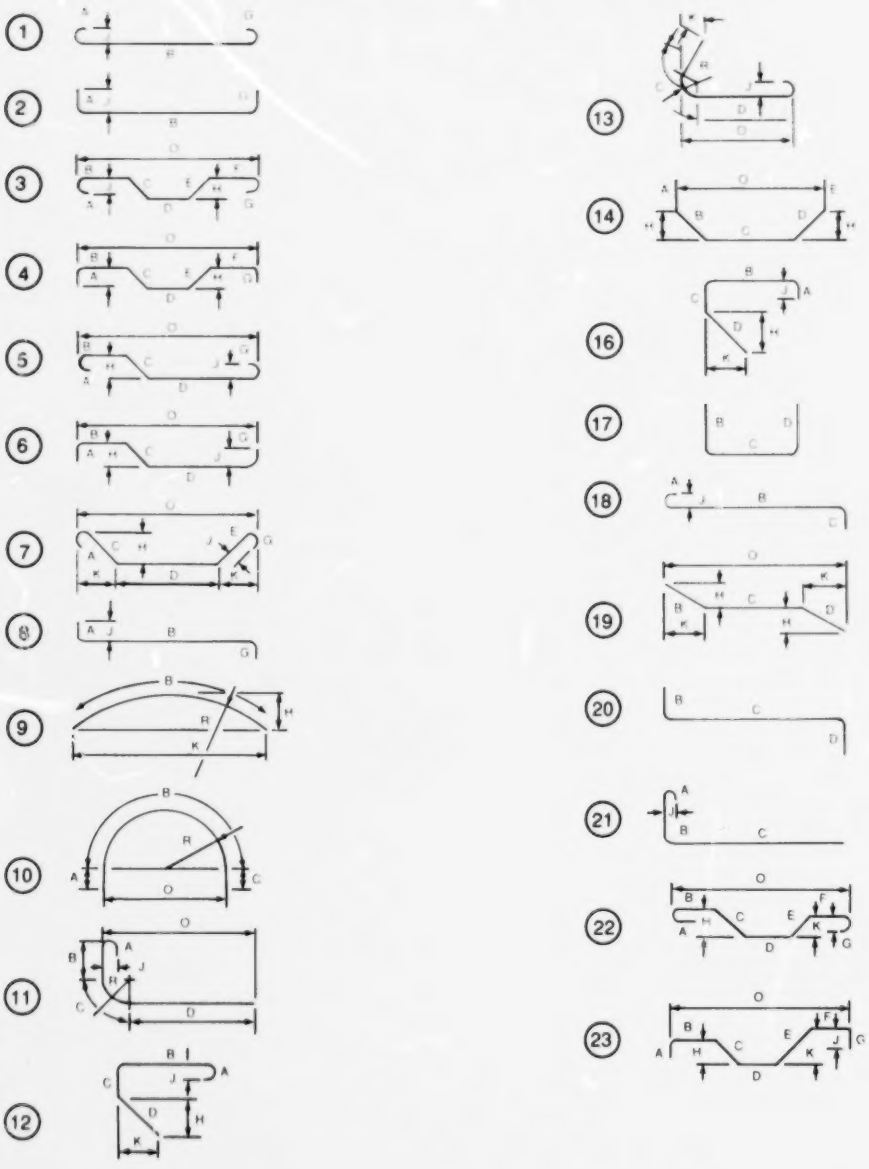
SUGGESTED ACTIVITIES

D. Manual of Standard Practice. Schaumburg, Illinois: Concrete Reinforcing Steel Institute, 1986.

E. Reinforcing Bar Supports catalog. Miamisburg, Ohio: Dayton Superior Corporation, 1982.

CONCRETE REINFORCING MATERIALS
UNIT I

SUPPLEMENT #1 — TYPICAL BAR BENDS



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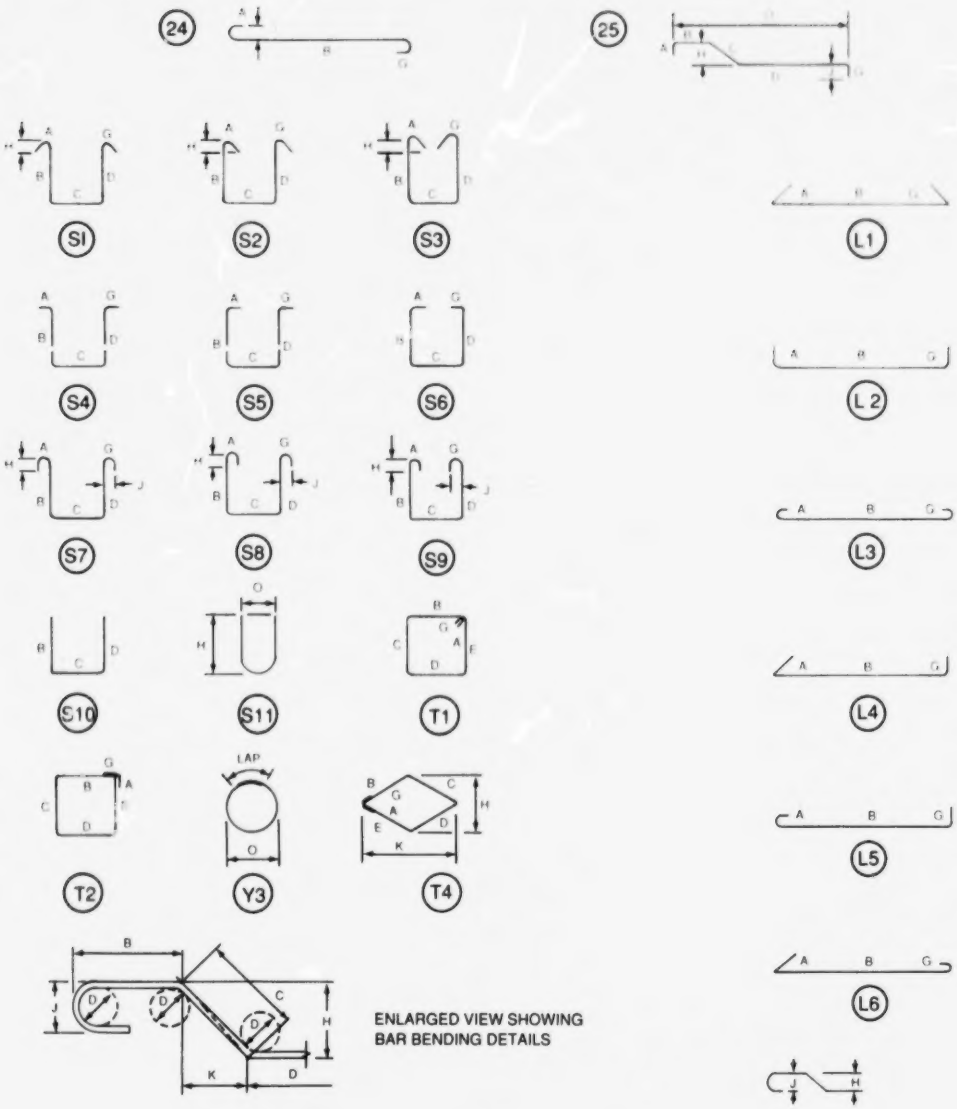
SUPPLEMENT #1



Notes

1. All dimensions are out to out of bar.
2. Where "J" is not shown, "J" will be kept equal to or less than "H". Where "J" can exceed "H", it should be shown.
3. Figures in circles show types.

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CONCRETE REINFORCING MATERIALS
UNIT I

INFORMATION SHEET

I. Terms and definitions associated with concrete reinforcing materials

A. **Axle steel** — Carbon-steel axles made for railroad cars.

B. **Billet steel** — Semi-finished steel, nearly square in section, formed by hot rolling an ingot or bloom.

C. **Bloom** — Lump of metal; a mass of wrought iron from the forge or puddling furnace.

D. **Double strong** — Two thicknesses of tie wire.

E. **Pigtails** — Manufactured, precut lengths of tie wire.

F. **PSI or psi** — Pounds per square inch.

G. **Rail steel** — Selected, used railroad rails.

H. **Rebar supports** — Formed wire devices, used to support, hold and space reinforcing bars.

I. **Reinforcing rod (rebars)** — Deformed steel bar.

J. **Tensile strength** — Capacity for resisting a bending, stretching, or twisting force.

K. **Welded wire fabric** — Steel used to reinforce concrete by being placed in such a manner so that the metal and concrete act together in resisting forces.

L. **Wire ties** — Method used to fasten reinforcing rods or wire fabric together.

INFORMATION SHEET

II. Common sizes of welded wire fabric

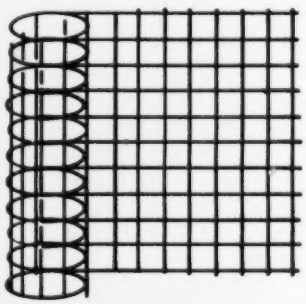
A. Rolls

(Note: Rolls of welded wire fabric is manufactured 5 feet wide by 150 feet long which is 750 square feet; usually used in flat concrete work such as floor slabs, pavements, sidewalks, and such. The first two numbers indicate the spacing of the steel. 6 x 6 means the steel is spaced six inches apart both ways. The second two numbers indicate the size (diameter) of the steel fabric. W1.4 x W1.4 means the steel is 10 gage, etc.)

EXAMPLE

FIGURE 1 6 x 6 - W 2.9 x W 2.9

1. 6 x 6 - W 1.4 x W 1.4
2. 6 x 6 - W 2.0 x W 2.0
3. 6 x 6 - W 2.9 x W 2.9
4. 6 x 6 - W 4.0 x W 4.0
5. 4 x 4 - W 1.4 x W 1.4
6. 4 x 4 - W 2.0 x W 2.0
7. 4 x 4 - W 2.9 x W 2.9
8. 4 x 4 - W 4.0 x W 4.0



B. Sheets (mats)

(NOTE: Sheet welded wire fabric is manufactured 8 feet wide by 20 feet long which is 160 square feet.)

1. 6 x 6 - W 2.9 x W. 2.9
2. 6 x 6 - W 4.0 x W 4.0
3. 6 x 6 - W 5.5 x W 5.5
4. 4 x 4 - W 4.0 x W 4.0
5. 4 x 4 - W 5.5 x W 5.5

INFORMATION SHEET

III. Standard rebar sizes

(NOTE: Diameters are designated by numbers, each number denotes 1/8 inch; these bars are rolled into lengths up to 60 feet in length.)

A. #2 — 1/4" rod diameter

(NOTE: #2 bar may be ribbed or smooth.)

FIGURE 2

RIBBED SMOOTH

B. #3 — 3/8" rod diameter

FIGURE 3

C. #4 — 1/2" rod diameter

FIGURE 4

D. #5 — 5/8" rod diameter

FIGURE 5

E. #6 — 3/4" rod diameter

FIGURE 6

F. #7 — 7/8" rod diameter

FIGURE 7

G. #8 — 1" rod diameter

FIGURE 8

H. #9 — 1 1/8" rod diameter

FIGURE 9

I. #10 — 1 1/4" rod diameter

FIGURE 10

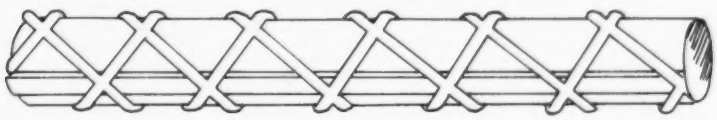
INFORMATION SHEET

J. #11 — 1 3/8" rod diameter

FIGURE 11

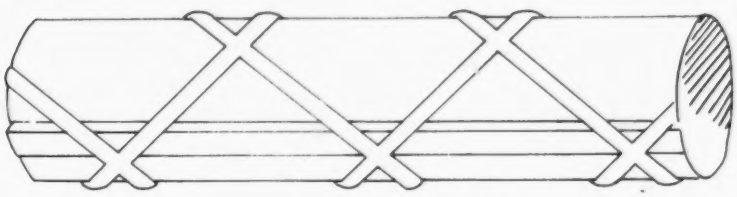
K. #14 — 1 3/4" rod diameter

FIGURE 12



L. #18 — 2 1/4" rod diameter

FIGURE 13



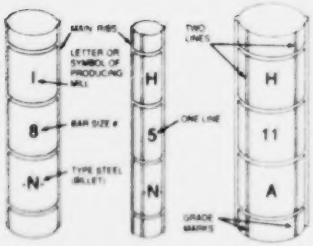
INFORMATION SHEET

IV. Line and number system identification marks for billet steel, rail steel, and axle steel, reinforcing bars

(NOTE: There is also an S for billet steel meeting supplementary requirements, an R for rail meeting bend test requirements and a W for Low-Alloy steel.)

A. Line System

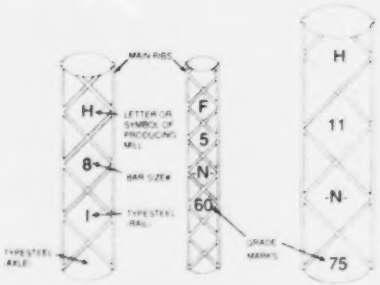
FIGURE 14



GRADE 40 GRADE 60 GRADE 75
GRADE 50

B. Number System

FIGURE 15



GRADE 40 GRADE 60 GRADE 75
GRADE 50

Adapted with permission of the Concrete Reinforcing Steel Institute.

1. First mark — Letter or symbol of the producing mill.
2. Second mark — Bar size number.
3. Third mark — Letters designating type of steel; N - billet, A - axle, I - rail.
4. Fourth mark - line system — lengthwise lines designate grades of steel; no line - Grade 40 & 50; one line - Grade 60; two lines - Grade 75. Number system — numbers show Grades 60 & 70; no numbers for 40 & 50.

   (NOTE: Grades 60 & 75 bars must show grade marks, either by lines or by numbers; one line for 60,000 psi, two lines for 75,000 psi; the grade line marks are small and are between the two main ribs which are on opposite sides of all U.S. made bars.)

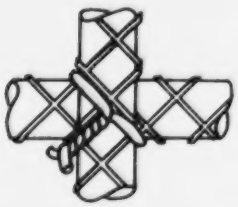
INFORMATION SHEET

V. Types of wire ties used to install rebars

(NOTE: 16 gauge, black annealed wire or wire pigtails are used to make the ties below.)

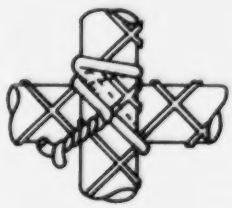
A. Single tie (snaptie)

FIGURE 16



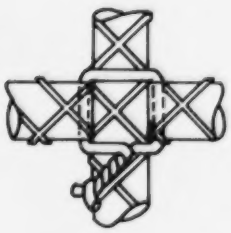
B. Wall tie (wrap and snaptie)

FIGURE 17



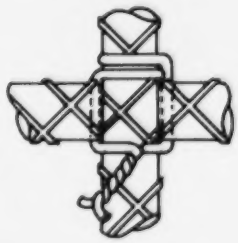
C. Saddle tie

FIGURE 18



D. Saddle tie with twist (wrap and saddle tie)

FIGURE 19

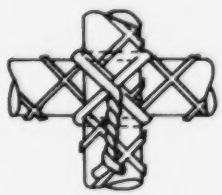


E. Double strong single tie

FIGURE 20

F. Cross tie (figure eight tie)

FIGURE 21



INFORMATION SHEET

G. Simple tie used as a lap tie

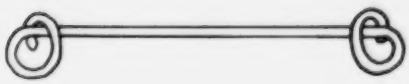
FIGURE 22

H. Tie wire

FIGURE 23

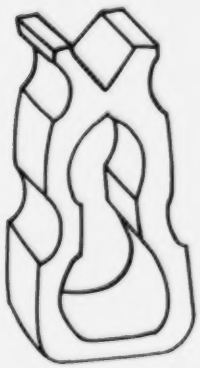
I. Wire tie (pigtail)

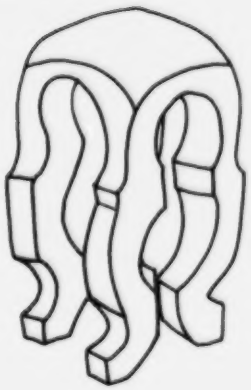
FIGURE 24



J. Plastic rebar fasteners

FIGURE 25





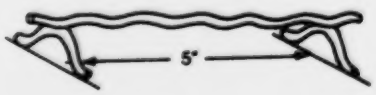
Used with permission of Clip Con-Rebar Fasteners & Supplies.

INFORMATION SHEET

VI. Types of rebar supports and their symbols

A. Slab bolster (SB)

FIGURE 26

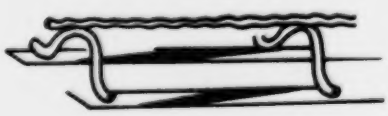


B. Slab bolster upper (SBU)

FIGURE 27

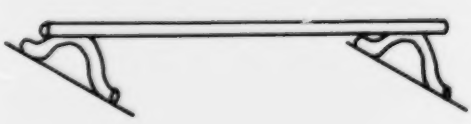
C. Slab bolster with plates (SBP)

FIGURE 28



D. Slab spacer (SS)

FIGURE 29



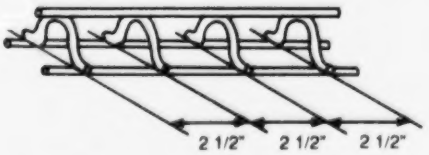
E. Beam bolster (BB)

FIGURE 30

INFORMATION SHEET

F. Beam bolster upper (BBU)

FIGURE 31



G. Individual bar chair (BC)

FIGURE 32

H. Joist chair (JC)

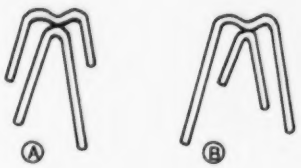
FIGURE 33

I. Individual high chair (HC)

FIGURE 34

J. High chairs for metal deck (HCM)

FIGURE 35



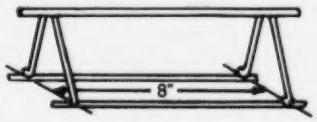
INFORMATION SHEET

K. Continuous high chair (CHC)

FIGURE 36

L. Continuous high chair upper (CHCU)

FIGURE 37

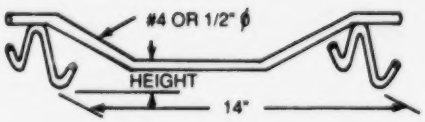


M. Continuous high chair for metal deck (CHCM)

FIGURE 38

N. Upper joist chair (UJC)

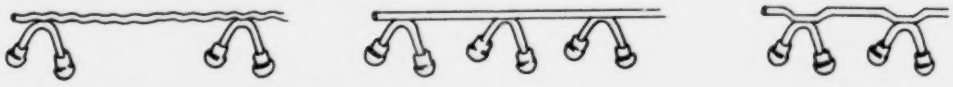
FIGURE 39



(NOTE: All of the above supports come in various sizes and several of them come with plastic caps and are used where bottom of deck is exposed to the elements. See examples below.)

INFORMATION SHEET

EXAMPLES



O. Special wire bar supports

(NOTE: The special supports below are just a few of the methods used to support the upper mast of a thick concrete slab with two layers of rebars; in some cases such as the dowel block, the special support will support both mats.)

1. High chair with plates (HCP)

   EXAMPLES:

   FIGURE 40

2. Standee

   FIGURE 41

Figures 26, 27, 28, 30, 31, 32, 33, 34, 36, 37 and 38 used with permission of Maxwell Supply Company.

Figures 35, 39 and 40 used with permission of Dayton Superior Corporation.

Figure 41 used with permission of the Concrete Reinforcing Steel Institute.

INFORMATION SHEET

VII. Types of rebar splices

A. Wire tie lap splice

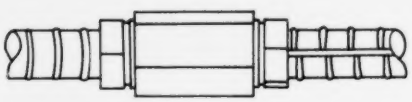
FIGURE 42

B. G-loc butt splice

FIGURE 43

C. Steel coupler type splice

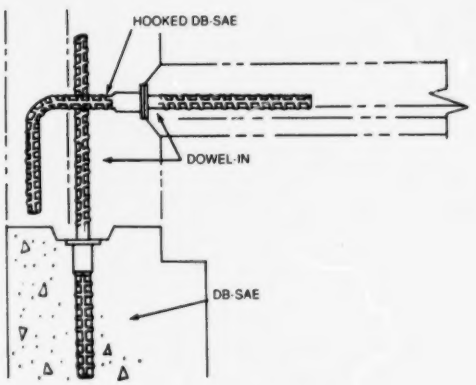
FIGURE 44



Used with permission of Erico Products, Inc.

D. Dowel bar splicer and dowel-in splicer system

FIGURE 45

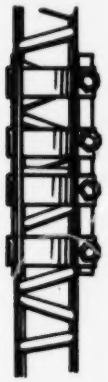


Used with permission of Richmond Screw Anchor Co.

INFORMATION SHEET

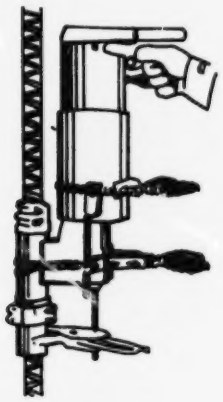
E. Speed sleeve butt splice

FIGURE 46



F. Cadweld butt splice

FIGURE 47



Figures 46 and 47 used with permission of Erico Products, Inc.

VIII. Types of reinforcing bars

A. Steel

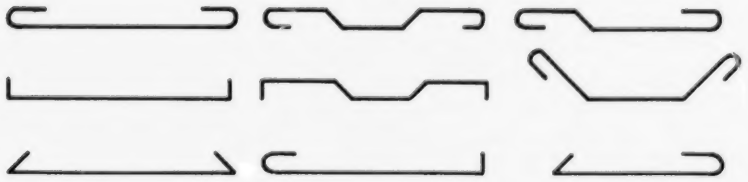
B. Epoxy coated

C. Zink cromate

IX. Shapes of reinforcing bars

A. Shear or truss bars

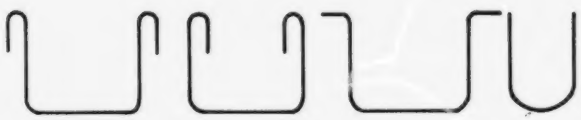
FIGURES 48



INFORMATION SHEET

B. Stirrups

FIGURES 49



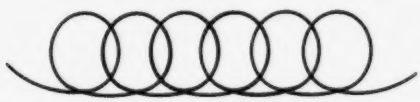
C. Column

FIGURE 50

1. Square

2. Round

3. Spiral



CONCRETE REINFORCING MATERIALS
UNIT I

ASSIGNMENT SHEET #1 — IDENTIFY REBARS BY LINES AND NUMBERS

NAME_____SCORE_____

The installer must be able to verify identification markings on rebars to be sure the correct grades and sizes are being placed in the locations where they are intended. There are some variations in bar identification marks: some markings may be read horizontally; grade mark numbers may be placed within separate consecutive deformation spaces and may read vertically or horizontally, and grade mark lines must be continued at least five deformation spaces. If the worker cannot read the markings for some reason he or she should check with the supervisor.

Using Information Sheet, Section IV, and the information above and below identify the markings on the rebars illustrated below and on the next page. Write the correct information in the blanks. Assume that the following names, initials or symbols are different producing mills.

C - Continental Steel Corporation

I - Inland Steel Company

F - Florida Steel Company

◊ - Diamond Steel Mill

B - Bethlehem Steel

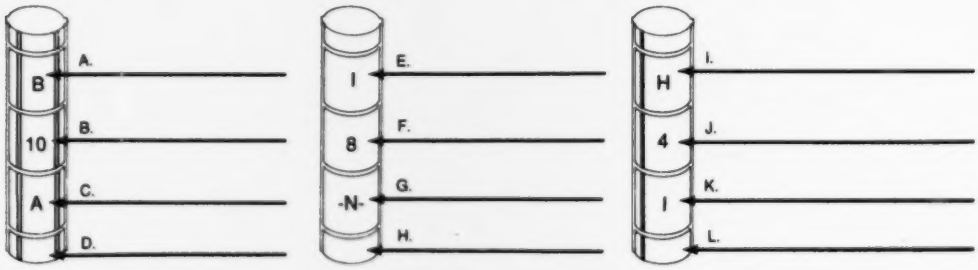
P - Pittsburg Steel Corporation

H - Holland Steel Company

L - Lynchburg Mills

a. Line system

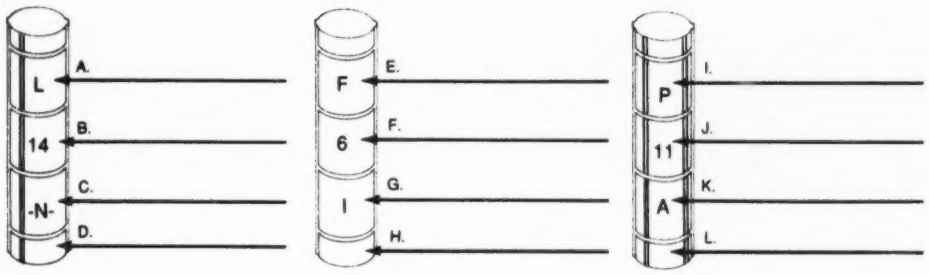
1.



Adapted with permission of the Concrete Reinforcing Steel Institute.

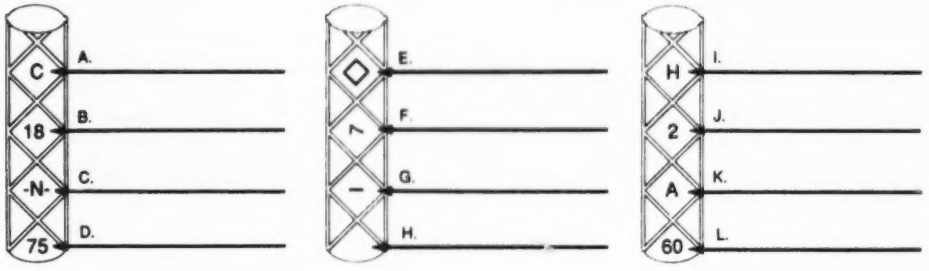
ASSIGNMENT SHEET #1

2.

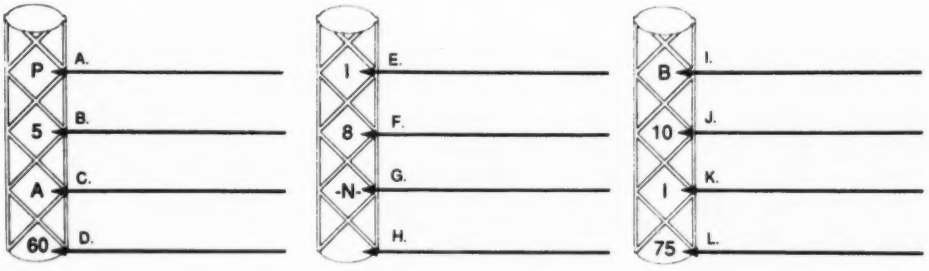


b. Number system

1.



2.



Adapted with permission of the Concrete Reinforcing Steel Institute.

CONCRETE REINFORCING MATERIALS
UNIT I

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

A. Line system

1. a. Bethlehem Steel
   b. 1 1/4 inch bar
   c. Axle steel
   d. Grade 75
   e. Inland Steel Company
   f. 1 inch bar
   g. Billet steel
   h. Grade 40-50
   i. Holland Steel Co.
   j. 1/2 bar
   k. Rail steel
   l. Grade 60

2. a. Lynchburg Mills
   b. 1 3/4 inch bar
   c. Billet steel
   d. Grade 60
   e. Florida Steel Company
   f. 3/4 inch bar
   g. Rail steel
   h. Grade 40-50
   i. Pittsburg Steel Corp.
   j. 1 3/8 inch bar
   k. Axle steel
   l. Grade 75

B.

1. a. Continental Steel Corp.
   b. 2 1/4 inch bar
   c. Billet steel
   d. Grade 75
   e. Diamond Steel Mill
   f. 7/8 inch bar
   g. Rail steel
   h. Grade 40-50
   i. Holland Steel Co.
   j. 1/4 inch bar
   k. Axle steel
   l. Grade 60

2. a. Pittsburg Steel Corp.
   b. 5/8 inch bar
   c. Axle steel
   d. Grade 60
   e. Inland Steel Co.
   f. 1 inch bar
   g. Billet steel
   h. Grade 40-50
   i. Bethlehem Steel
   j. 1 1/4 inch bar
   k. Rail steel
   l. Grade 75

CONCRETE REINFORCING MATERIALS
UNIT I

TEST

NAME_____SCORE_____

1. Match terms associated with concrete reinforcing material to their correct definitions. Write the correct numbers in the blanks.

_____a. Steel used to reinforce concrete by being placed in such a manner so that the metal and concrete act together in resisting forces

_____b. Semi-finished steel, nearly square in section, formed by hot rolling an ingot or bloom

_____c. Lump of metal; a mass of wrought iron from the forge or puddling furnace

_____d. Carbon steel axles made from railroad cars

_____e. Selected, used railroad rails

_____f. Method used to fasten reinforcing rods or wire fabric together

_____g. Manufactured, precut lengths of tie wire

_____h. Two thicknesses of tie wire

_____i. Pounds per square inch

_____j. Formed wire devices, used to support, hold and space reinforcing bars

_____k. Deformed steel bar

_____l. Capacity for resisting a bending, stretching, or twisting force

1. Rail steel
2. Double strong
3. Reinforcing rod (rebar)
4. Welded wire fabric
5. Wire ties
6. PSI or psi
7. Axle steel
8. Tensile strength
9. Billet steel
10. Rebar supports
11. Pigtails
12. Bloom

TEST

2. Select from the following list common sizes of welded wire fabric. Mark an "X" in the correct blanks.

a. Rolls	b. Sheets
_____1. 4 x 4 - W 1.4 x W 1.4	_____1. 6 x 6 - W 4.5 x W 4.5
_____2. 6 x 6 - W 2.9 x W 2.9	_____2. 4 x 4 - W 5.5 x W 5.5
_____3. 4 x 4 - W 5.5 x W 5.5	_____3. 4 x 4 - W 1.4 x W 1.4
_____4. 4 x 4 - W 2.9 x W 2.9	_____4. 6 x 6 - W 2.9 x W 2.9
_____5. 6 x 6 - W 1.4 x W 1.4	_____5. 6 x 6 - W 5.5 x W 5.5
_____6. 6 x 6 - W 1.0 x W 1.0	_____6. 4 x 4 - W 2.0 x W 2.0
_____7. 4 x 4 - W 2.0 x W 2.0	_____7. 6 x 6 - W 4.0 x W 4.0
_____8. 6 x 6 - W 2.0 x W 2.0	_____8. 4 x 4 - W 4.0 x W 4.0

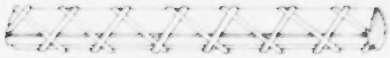
3. Identify the following sizes of standard reinforcing bars. Write the correct size # in the blanks.

Sizes #2 through #11 and #14 and #18

a. _____ b. _____

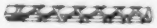
c. _____ d. _____

TEST

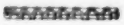


e. _____ f. _____

g. _____ h. _____



i. _____ j. _____

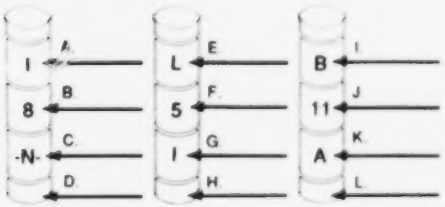


k. _____ l. _____

m. _____

4. Match lines and numbers on rebars to their identifications. Write the correct numbers in the blanks.

a. Line system



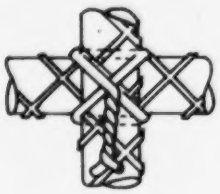
1. Bar sizes (give size in inches)
2. Producing mill initial
3. Type of steel (name type)
4. Grade of steel (give grade)

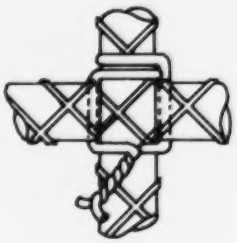
TEST

b. Number system

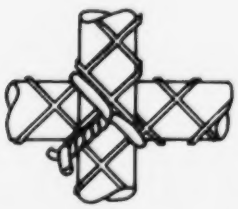
5. Identify the following types of wire ties used to install rebars. Write the correct names in the blanks.

Wall tie	**Cross tie**	**Saddle tie with twist**
Single tie	**Saddle tie**	**Lap tie**
Double strong single tie	**Tie wire**	**Plastic rebar fasteners**
Wire tie		



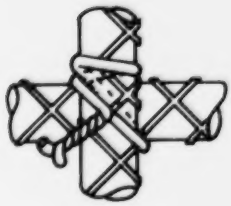


a. _____ b. _____

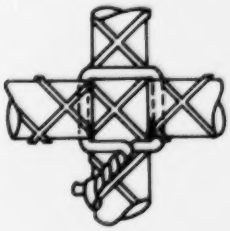


c. _____ d. _____

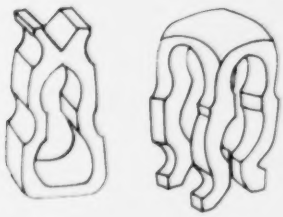
TEST



e. _____ f. _____



g. _____ h. _____



i. _____ j. _____

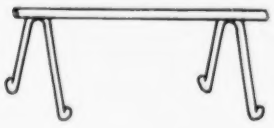
TEST

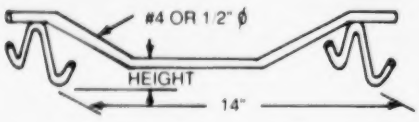
6. Identify the following types of rebar supports. Write the correct names in the blanks.

Special wire bar supports
Continuous high chair for metal deck
Slab bolster
Slab bolster upper
Slab bolster with plates
Beam bolster
Joist chair
Individual bar chair

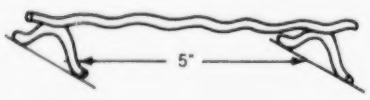
Upper joist chair
Continuous high chair upper
Continuous high chair
High chair for metal deck
Individual high chair
Slab spacer
Beam bolster upper

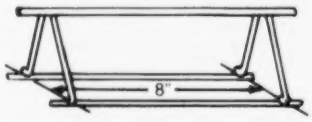
a. _____ b. _____





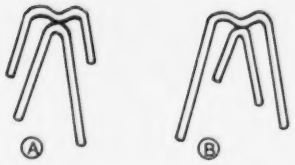
c. _____ d. _____





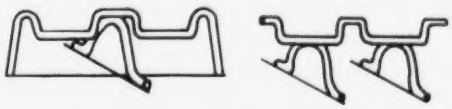
e. _____ f. _____

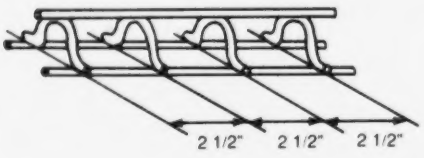
TEST



g. _____ h. _____

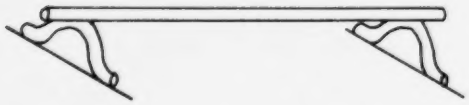
i. _____ j. _____





k. _____ l. _____

TEST



m. _____ n. _____

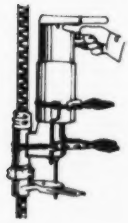
o. _____ p. _____

7. Identify the following types of rebar splices. Write the correct names in the blanks.

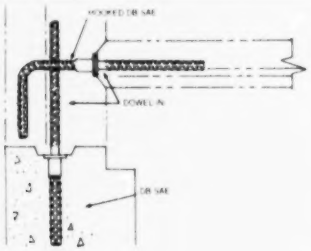
Cadweld butt splice
Wire tie lap splice
Double bar splicer and dowel-in splicer system
Steel coupler type splice
G-loc butt splice
Speed sleeve butt splice

a. _____ b. _____

TEST



c. _____ d. _____



e. _____ f. _____

8. Name three types of reinforcing bars.

a. _____

b. _____

c. _____

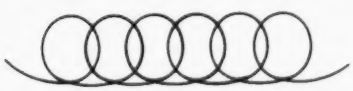
9. Identify the following shapes of reinforcing bars.

a. _____ b. _____

TEST

c. _____ d. _____

e. _____ f. _____



g. _____ h. _____

CONCRETE REINFORCING MATERIALS
UNIT I

ANSWERS TO TEST

1. a. 4 d. 7 g. 11 j. 10
   b. 9 e. 1 h. 2 k. 3
   c. 12 f. 5 i. 6 l. 8

2. a. Rolls
   1, 2, 4, 5, 7, 8
   b. Sheets
   2, 4, 5, 7, 8

3. a. #18 e. #10 h. #5 k. #2
   b. #4 f. #9 i. #14 l. #11
   c. #8 g. #6 j. #3 m. #7
   d. #2

4. a. Line system
   a. 2 e. 2 i. 2
   b. 1, 1 inch f. 1, 5/8 inches j. 1, 1 3/8 inches
   c. 3, Billet g. 3, Rail k. 3, Axle
   d. 4, Grade 40-50 h. 4, Grade 60 l. 4, Grade 75

   b. Number system
   a. 2 e. 2 i. 2
   b. 1, 3/8 inches f. 1, 1 1/8 inches j. 1, 2 1/4 inches
   c. 3, Rail g. 3, Axle k. 3, Billet
   d. 4, Grade 40-50 h. 4, Grade 60 l. 4, Grade 75

5. a. Cross tie f. Lap tie
   b. Saddle tie with twist g. Saddle tie
   c. Single tie h. Wire tie
   d. Double strong single tie i. Plastic rebar fasteners
   e. Wall tie j. Tie wire

ANSWERS TO TEST

6. a. Individual high chair
   b. Beam bolster
   c. Continuous high chair
   d. Upper joist chair
   e. Slab bolster
   f. Continuous high chair upper
   g. High chairs for metal deck
   h. Individual bar chair
   i. Slab bolster upper
   j. Continuous high chair for metal deck
   k. Joist chair
   l. Beam bolster upper
   m. Special wire bar support
   n. Slab spacer
   o. Special wire bar support
   p. Slab bolster with plates

7. a. Speed sleeve butt splice
   b. Steel coupler type splice
   c. G-loc butt splice
   d. Cadweld butt splice
   e. Double bar splicer and dowel-in splicer system
   f. Wire tie lap splice

8. Answer should include:
   a. Steel
   b. Epoxy coated
   c. Zink cromate

9. a. Stirrup
   b. Shear or truss bar
   c. Shear or truss bar
   d. Round column
   e. Shear or truss bar
   f. Stirrup
   g. Spiral column
   h. Square column

CONCRETE REINFORCING TOOLS
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to identify the various tools and equipment used to install reinforcing. The student will show this ability by completing the unit test with a minimum score of 80 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with reinforcing tools to their correct definitions.
2. State guidelines for care and safe use of reinforcing tools.
3. Identify tools used to install concrete reinforcing steel.
4. State general rules to follow when using steel reinforcing.
5. State proper way to lay out rebars.

CONCRETE REINFORCING TOOLS
UNIT II

SUGGESTED ACTIVITIES

I. Unit contents

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Test

E. Answers to test

II. Instructor's guide

A. Review unit and plan presentation.

B. Obtain materials to supplement unit.

1. Manufacturer's tool catalogs

2. Safety posters

3. Samples of various tools

4. You may want to supplement this unit with a copy of the welding book and unit on rigging.

C. Introduce unit to students.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives.

F. Provide students with information sheets.

G. Discuss information sheets.

1. Use information Sheet, Section I, to discuss terms and definitions associated with concrete reinforcing

- Show students samples of appropriate terms.

SUGGESTED ACTIVITIES

- Point out the importance of defining terms for common understanding.

2. Use Information Sheet, Sections II and III, to discuss guidelines for care and safe use of concrete reinforcing tools and to discuss tools used to install concrete reinforcing steel.

   - Explain the importance of buying quality tools.
   - Discuss how good care will preserve the tools so that they will last many years.
   - Outline your tool management system for shop and job site.
   - Have students explain details of accidents they know of when someone used tools improperly.
   - Discuss newspaper clippings or case studies that relate to improper use of tools.
   - Demonstrate the proper use of the various tools, then have students repeat the demonstrations so they may get the feel of the various tools.
   - Caution students to wear safety equipment especially eye protection when using chisels, punches and drive pins.
   - Display a sample of each type of tool discussed in this section of the information sheet.
   - Have students play a game of identifying each tool then another student explain the use of the tool; give points for correct answers and take away points for incorrect answers.

H. Review information sheet.

   - Have each student demonstrate correct operation of all tools and equipment and have the other students critique the performances.

I. Give test.

J. Critique test and discuss in class.

K. Reteach and retest as necessary.

L. Complete appropriate section of competency profile.

SUGGESTED ACTIVITIES

III. Unit reference

A. Hendrix, Laborn J. "Bud." *Construction Craftsman's Curriculum. Instructional Materials.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1980.

B. Hendrix, Laborn J. "Bud." *Millwright Instructional Materials.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1980.

CONCRETE REINFORCING TOOLS
UNIT II

INFORMATION SHEET

I. Terms and definitions associated with concrete reinforcing tools

A. **Soapstone** — Soft stone having a soapy feel and composed essentially of talc, chlorite, and often magnetite

B. **Plumb bob** — Tool or device attached to a string; used to set and check vertical or perpendicular of a surface

C. **Perpendicular** — Exactly upright; at a right angle (90 degree angle) to another line or surface

II. Guidelines for care and safe use of reinforcing tools

A. Use correct tool for the job

B. Keep tools sharp

C. Keep tools clean

D. Inspect tools frequently to make sure they are in good condition

E. Repair broken or damaged tools promptly

F. Dispose of broken or damaged tools that cannot be repaired

G. Keep tools within easy reach when working on a project

H. Oil tools that may not be used for some time

I. Never place tools on finished parts

J. Never place tools where they may fall

K. Stay alert when using tools

L. Wear eye protection when necessary

M. Store tools properly when not in use

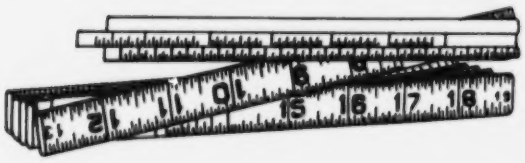
INFORMATION SHEET

III. Tools used to install concrete reinforcing steel

A. Measuring devices

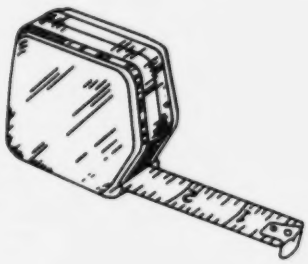
1. Folding rule

FIGURE 1



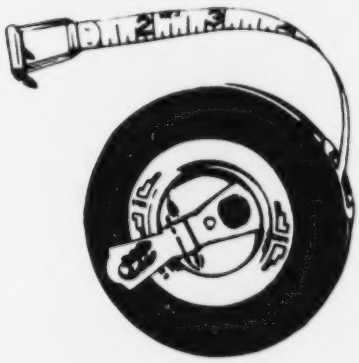
2. Steel tape

FIGURE 2



3. 100 foot tape

FIGURE 3



B. Marking devices

1. Pencil

FIGURE 4

2. Keel (lumber crayon)

FIGURE 5

3. Soapstone

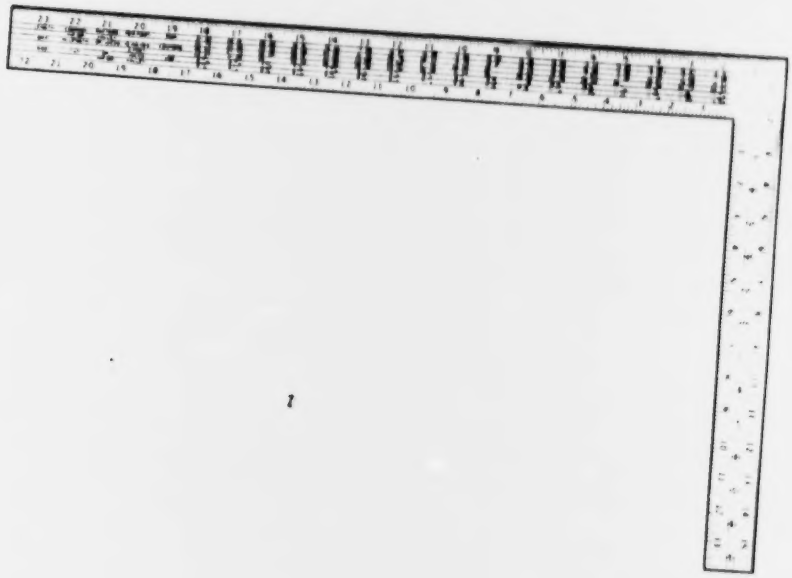
FIGURE 6

INFORMATION SHEET

C. Layout devices

1. Framing square

FIGURE 7

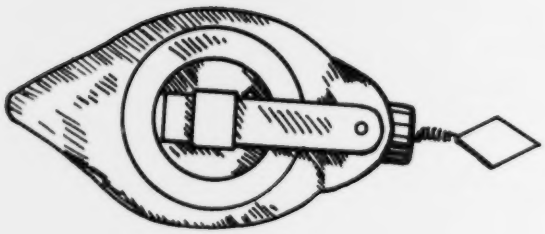


2. Plumb bob

FIGURE 8

3. Chalk box

FIGURE 9



INFORMATION SHEET

D. Hand levels

1. 48-inch mason's

FIGURE 10

2. Utility

FIGURE 11

E. Pliers

1. Side cutters

FIGURE 12

2. High leverage side cutters

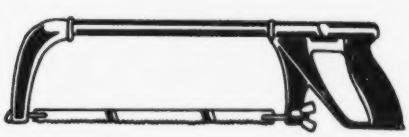
FIGURE 13

Used with permission of Maxwell Supply Company.

F. Cutting tools

1. Hacksaw

FIGURE 14



2. Bolt cutters

FIGURE 15

INFORMATION SHEET

G. Tie wire reel

FIGURE 16

H. Tying tool

FIGURE 17

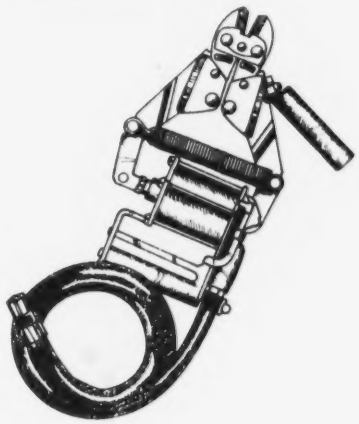
Figures 16 and 17 used with permission of Maxwell Supply Company.

I. Rod bender (Hickey)

FIGURE 18

J. Portable air powered cutter

FIGURE 19

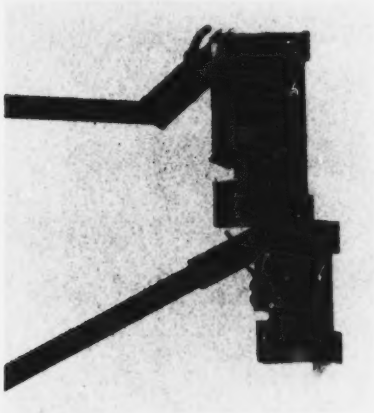


Used with permission of Bidwell, a subsidiary of CMI Corporation.

INFORMATION SHEET

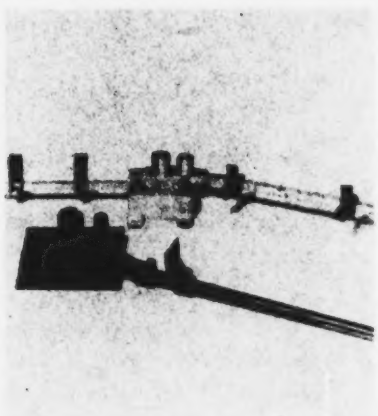
K. Hand rebar cutter

FIGURE 20



L. Rebar bender for stirrups

FIGURE 21



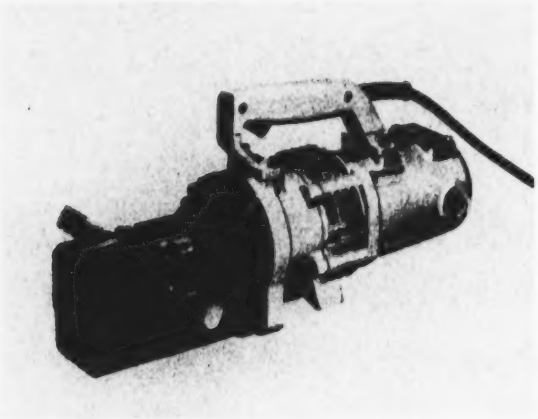
INFORMATION SHEET

M. Power bar shears

FIGURE 22

N. Power rebar cutters

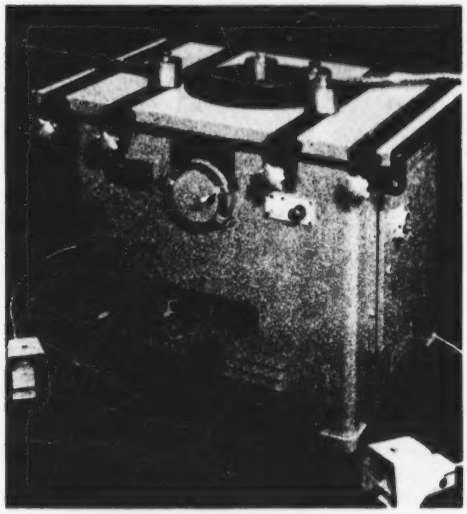
FIGURE 23



INFORMATION SHEET

O. Power bar bender

FIGURE 24



Figures 20-24 used with permission of N. E. Wennerholm & Co., Inc.

IV. General rules to follow when using steel reinforcing

A. Use clean steel free from dust, paint, and scale.

B. Place steel as determined by building code, plans, or specifications.

C. Lap bars a minimum of twenty-four times their diameter and never less than twelve inches or according to specifications.

D. Butt weld bars according to specifications.

E. Place reinforcing where the concrete will be in tension.

F. Tie reinforcing solidly so that it cannot shift when concrete is placed.

G. Never use incorrectly marked rebars.

INFORMATION SHEET

V. Proper way to layout rebars

A. Mark at 12 inch centers.

B. Lay cross bars at 12 inch centers.

CONCRETE REINFORCING TOOLS
UNIT II

TEST

NAME_____ SCORE_____

1. Match terms associated with concrete reinforcing tools to their correct definitions. Write the correct numbers in the blanks.

_____a. Tool or device attached to a string; used to set and check vertical or perpendicular of a surface	1. Soapstone
_____b. Soft stone having a soapy feel and composed essentially of talc, chlorite, and often magnetite.	2. Perpendicular
_____c. Exactly upright; at a right angle (90 degree angle) to another line or surface	3. Plumb bob

2. State eight guidelines for care and safe use of tools.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

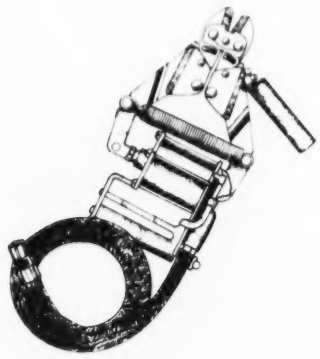
g. _____

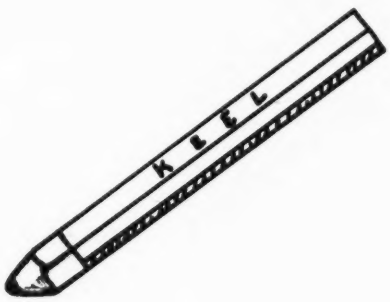
h. _____

TEST

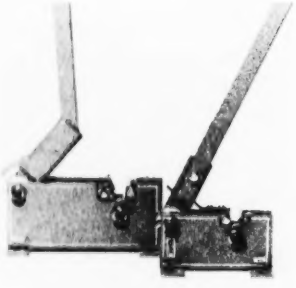
3. Identify tools used to install concrete reinforcing steel. Write the correct names in the blanks.

Hand rebar cutter	**Folding rule**	**100 foot tape**
Utility level	**Rebar bender for stirrups**	**Steel tape**
Soapstone	**Chalk box**	**Power bar shears**
Pencil	**Framing square**	**Plumb bob**
Power rebar cutters	**Keel**	**48 inch mason's level**
Rod bender	**Side cutters**	**Bolt cutters**
Tie wire reel	**Power bar bender**	**Tying tool**
Hacksaw	**High leverage side cutters**	**Portable air powered cutter**





a. _____ b. _____



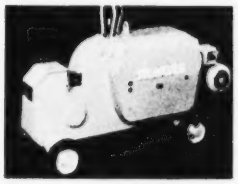
c. _____ d. _____

TEST

e. _____

f. _____

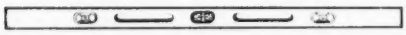
g. _____



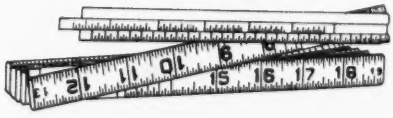
h. _____

i. _____

j. _____



k. _____

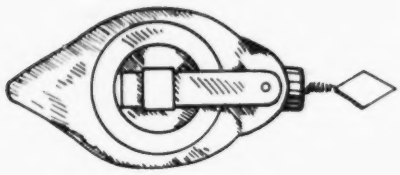


l. _____

m. _____

TEST

n. _____

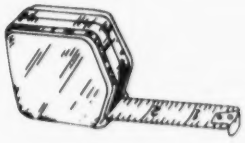


o. _____

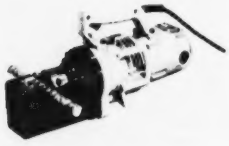
p. _____

q. _____

r. _____



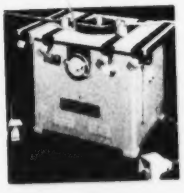
s. _____



t. _____

u. _____

v. _____



w. _____

TEST

4. State three general rules to follow when using steel reinforcing.

   a. _____

   _____

   b. _____

   _____

   c. _____

   _____

5. State proper way to layout rebars.

   a. _____

   b. _____

CONCRETE REINFORCING TOOLS
UNIT II

ANSWERS TO TEST

1. a. 3
   b. 1
   c. 2

2. Answer should include any eight of the following:

   a. Use correct tool for the job
   b. Keep tools sharp
   c. Keep tools clean
   d. Inspect tools frequently to make sure they are in good condition
   e. Repair broken or damaged tools promptly
   f. Dispose of broken or damaged tools that cannot be repaired
   g. Keep tools within easy reach when working on a project
   h. Oil tools that may not be used for some time
   i. Never place tools on finished parts
   j. Never place tools where they may fall
   k. Stay alert when using tools
   l. Wear eye protection when necessary
   m. Store tools properly when not in use

3. a. Portable air powered cutter
   b. Keel or lumber crayon
   c. Framing square
   d. Hand rebar cutter
   e. High leverage side cutters
   f. Utility level
   g. Plumb bob
   h. Power bar shears
   i. Soapstone
   j. Hacksaw
   k. 48-inch mason's level
   l. Folding rule
   m. Pencil
   n. Side cutters
   o. Chalk box
   p. Tying tool
   q. Rebar bender for stirrups
   r. Rod bender or hickey
   s. Steel tape
   t. Power rebar cutters
   u. Tie wire reel
   v. Bolt cutters
   w. Power bar bender

4. Answer should include any three of the following:

   a. Use clean steel free from rust, paint, and scale
   b. Place steel as determined by building code, plans, or specifications
   c. Lap bars a minimum of twenty four times their diameter and never less than twelve inches or according to specifications
   d. Butt weld bars according to specifications

ANSWERS TO TEST

e. Place reinforcing where the concrete will be in tension
f. Tie reinforcing solidly so that it cannot shift when concrete is placed
g. Never use incorrectly marked rebars

5. Answer should include:

a. Mark at 12 inch centers
b. Lay cross bars at 12 inch centers

CONCRETE REINFORCING BASIC SKILLS
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to perform the various job sheets demonstrated in this unit. The student will show this ability by completing the job sheets and the unit test with a minimum score of 80 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with concrete reinforcing basic skills to their correct definitions.
2. State basic skills used in reinforcing operations.
3. Demonstrate ability to:
   a. Install #4 reinforcing bars at 12" on center for a footing 6' x 6' using single tie.
   b. Install #4 reinforcing bars at 12" on center in a wall 4' x 8' using wall tie.
   c. Lay and tie welded wire fabric.

CONCRETE REINFORCING BASIC SKILLS
UNIT III

SUGGESTED ACTIVITIES

I. Unit contents

A. Objective sheet

B. Suggested activities

C. Supplement

1. Supplement #1 — Portion of a Typical Structural Drawing

D. Information sheet

E. Job sheets

1. Job Sheet #1 — Install #4 Reinforcing Bars at 12" on center for a Footing 6' x 6' using Single Tie

2. Job Sheet #2 — Install #4 Reinforcing Bars at 12" on center in a wall 4' x 8' using Wall Tie

3. Job Sheet #3 — Lay and Tie Welded Wire Fabric

F. Test

G. Answers to test

II. Instructor's guide

A. Review unit and plan presentation.

B. Obtain materials and plan presentation

- Obtain materials and equipment necessary to perform procedures in job sheets.

C. Introduce unit to students.

- Discuss general types of work and basic skills performed by ironworkers.
- Discuss procedures for completing basic skills.

SUGGESTED ACTIVITIES

- Discuss and emphasize the importance of proper safety precautions pertaining to concrete reinforcing operations.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives.

F. Provide students with information and job sheets.

G. Discuss information and job sheets.

1. Use Information Sheet, Section I, to discuss terms and definitions associated with concrete reinforcing basic skills.

    - Have students review terms and definitions.
    - Show samples or examples of terms if appropriate.
    - Point out the importance of understanding those terms and definitions and how knowing them will help students to better understand this unit.

2. Use Information Sheet, Section II, to discuss basic skills used in reinforcing operations.

    - Discuss in detail each of the specific jobs and skills done by reinforcing installers.
    - Invite a reinforcing installer to the class to discuss jobs with the students and the basic skills performed.
    - Take students on a field trip to a construction site where they will be able to observe reinforcing work being performed.
    - Discuss with students how many skills they observed on their field trip.
    - Discuss the importance of performing these skills properly.
    - Emphasize proper safety procedures when performing these skills.
    - Demonstrate proper procedures for completing job sheets.
    - Discuss procedures with the students, then give them the opportunity to practice them.

SUGGESTED ACTIVITIES

- Have students complete each of the job sheets.

H. Give test.

I. Critique test and discuss in class.

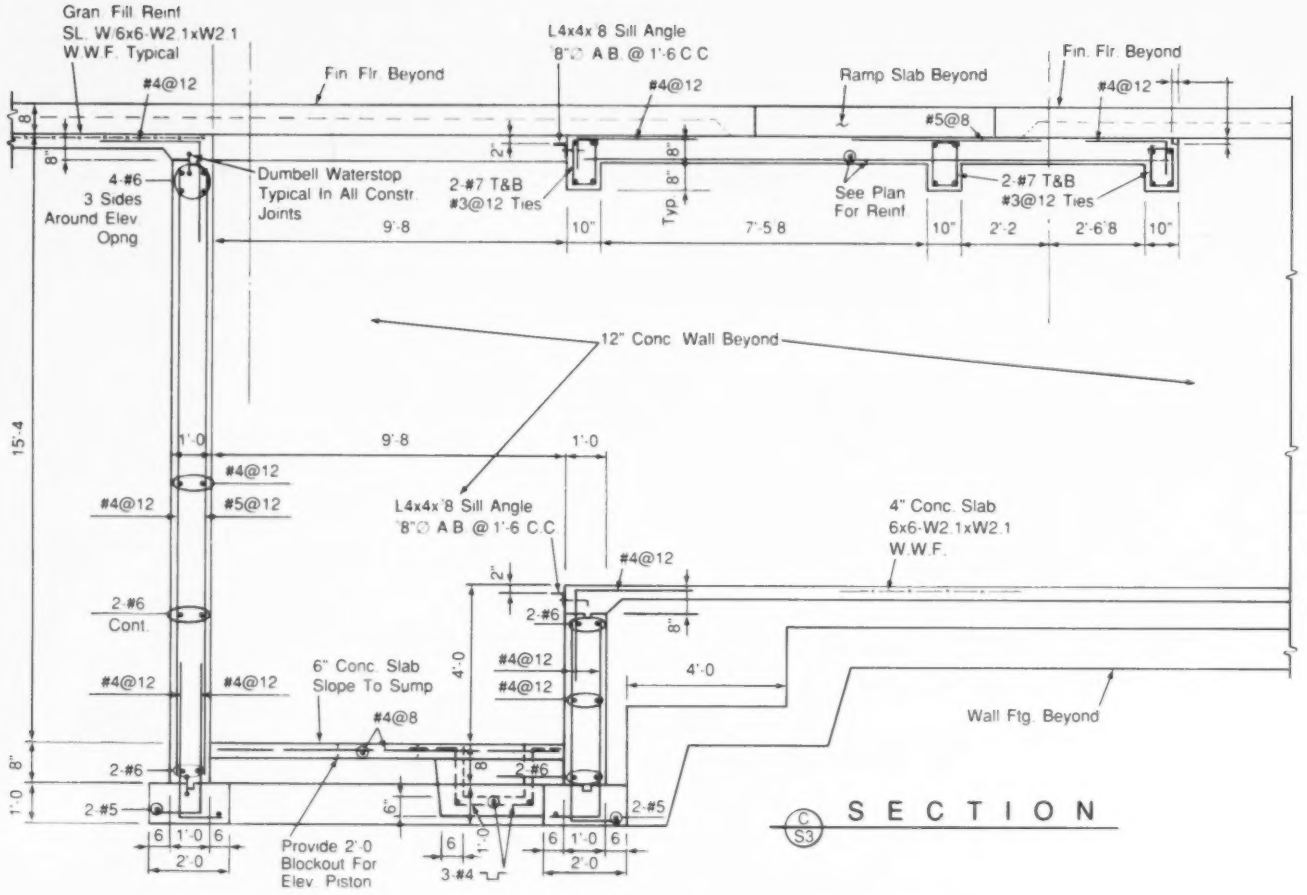
J. Reteach and retest if necessary.

K. Complete appropriate section of competency profiles.

III. Unit reference

A. Hendrix, Laborn J. "Bud". *Concrete and Cement Masonry Skills.* Stillwater, Oklahoma: State Department of Vocational Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1987.

SUPPLEMENT #1
PORTION OF A TYPICAL STRUCTURAL DRAWING



CONCRETE REINFORCING BASIC SKILLS
UNIT III

INFORMATION SHEET

I. Terms and definitions associated with concrete reinforcing basic skills

A. **Reinforcing steel** — Steel bars or wires embedded in concrete and located in such a manner that the metal and the concrete act together in resisting loads.

B. **Matt** — Grid of preassembled reinforcing bars.

C. **Dowels** — Reinforcing bars connecting two separately cast sections of concrete.

II. Basic skills used in reinforcing operations

A. Identify hand tools used in reinforcing work.

B. Ability to use and care for tools properly.

C. Identify equipment related to reinforcing.

D. Identify materials used in concrete reinforcing.

E. Use measuring, leveling and plumbing devices accurately.

F. Set up ladders and scaffolds properly.

G. Identify hitches, knots, and accessories used in rigging. (See rigging unit).

H. Rig and handle different types of loads.

I. Distinguish and give hand signals used in rigging operations.

J. Set up and use a cutting torch. (See Introduction to Welding.)

K. Set up and use a welder.

L. Identify concrete reinforcing symbols and abbreviations found on plans.

M. Make the various types of ties used to secure reinforcing.

N. Install reinforcing bars for footings.

O. Install reinforcing bars in walls, columns, and floor slabs.

P. Lay and tie welded wire fabric.

CONCRETE REINFORCING BASIC SKILLS
UNIT III

JOB SHEET #1 — INSTALL #4 REINFORCING BARS AT 12" ON CENTER FOR A FOOTING 6' X 6' USING SINGLE TIE

I. Tools and equipment

A. Side cutters, one pair

B. Folding rule or tape

C. Yellow keel, one piece

D. Wire reel and tie wire

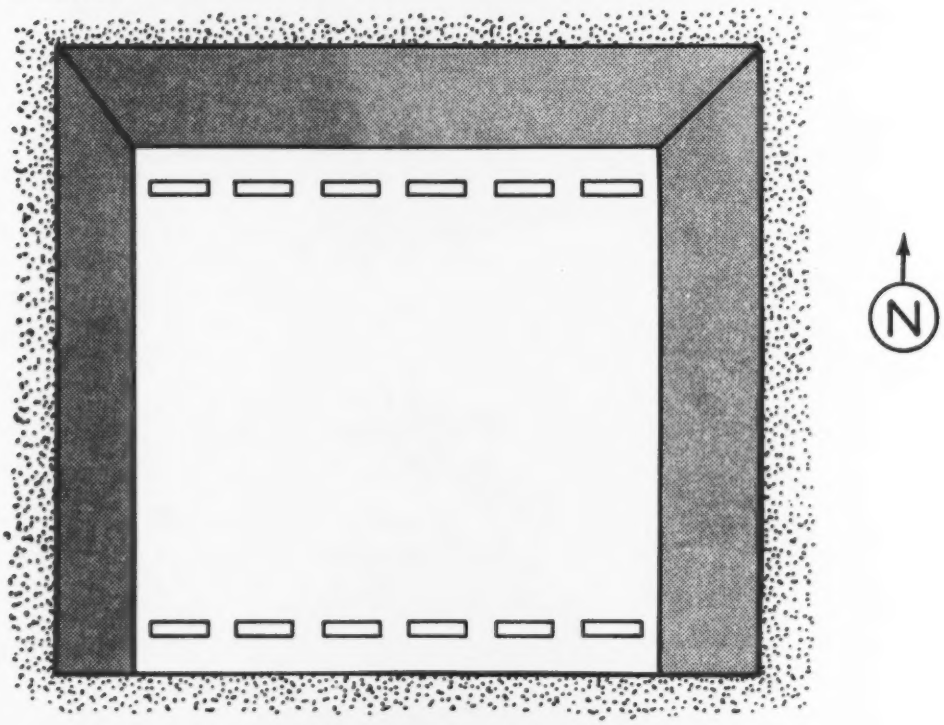
E. Twelve #4 rebars 5'-6" long

F. Twelve bricks or pieces of concrete bricks, chairs, or bolsters as per specifications

II. Procedure

A. Place six bricks, chairs, or bolsters flat on bottom of footing at north and south ends approximately twelve inches apart to support the rebars (Figure 1).

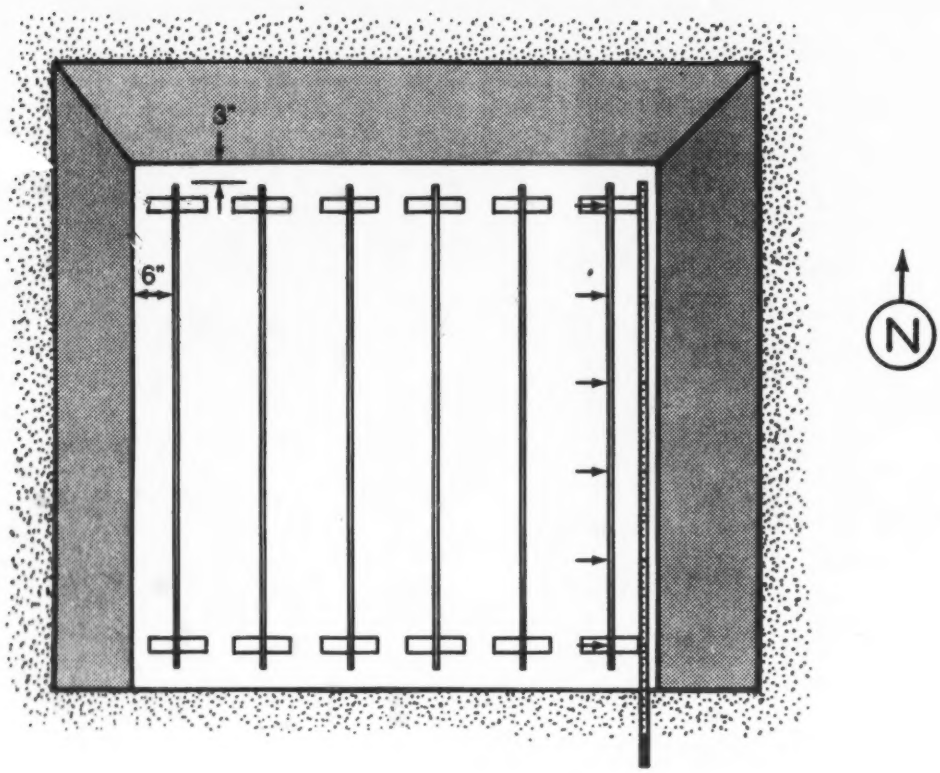
FIGURE 1



JOB SHEET #1

B. Place six rods across the bricks, laying rods north and south, with the two outside rods six inches in from the edge of the footing; using keel and rule, place marks on two outside rods twelve inches apart, starting three inches from end (Figure 2) (NOTE: When installing rods against earth a three inch clearance between end of rod and earth is required).

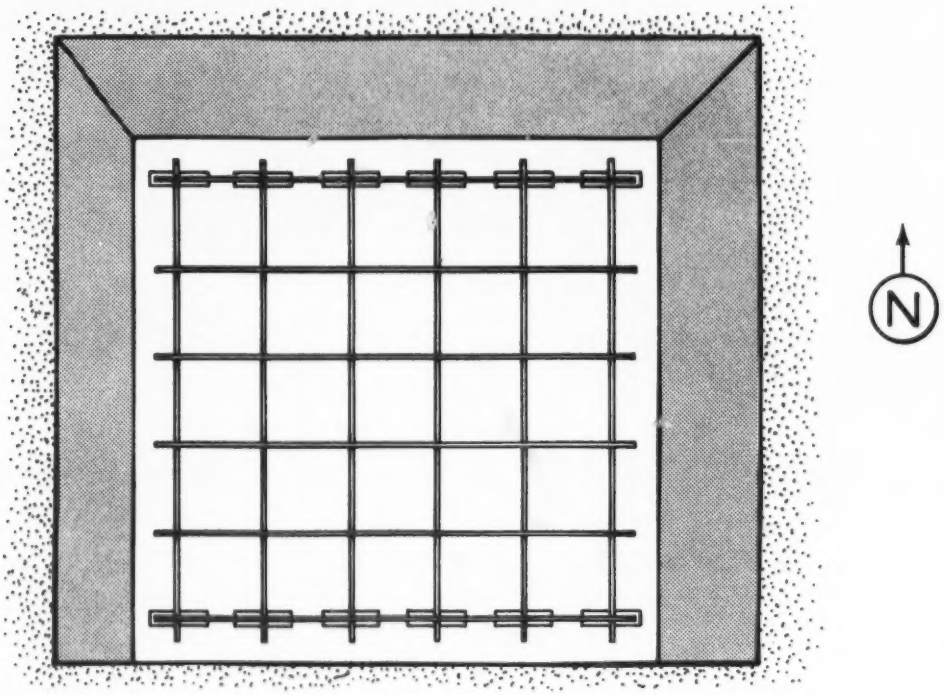
FIGURE 2



JOB SHEET #1

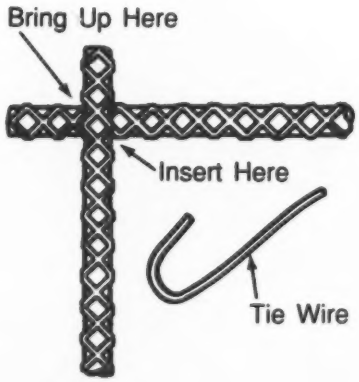
C. Place remaining six rods across other six rods aligning them with the twelve-inch mark (Figure 3).

FIGURE 3



D. Pull a small amount of wire from reel and put small hook in the end of tie wire; with left hand insert wire down and under the two rods so that end will come up on opposite side (Figure 4).

FIGURE 4

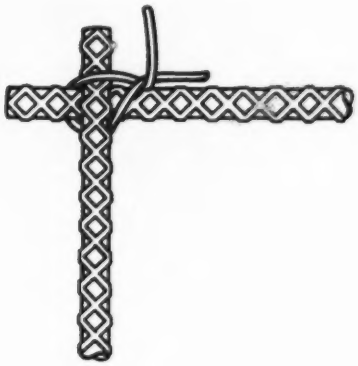


JOB SHEET #1

E. Hold wire with left hand; grasp both sections with side cuts and twist (Figures 5 and 6).

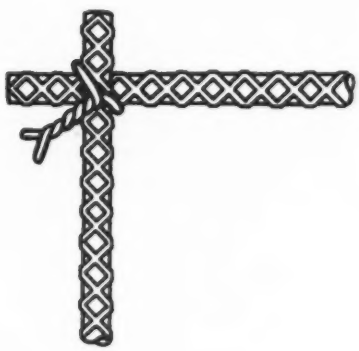
FIGURE 5

FIGURE 6



F. Make about five or six twists; cut both wires so there will be approximately three-quarters of an inch left; then tap these ends down with pliers (Figure 7).

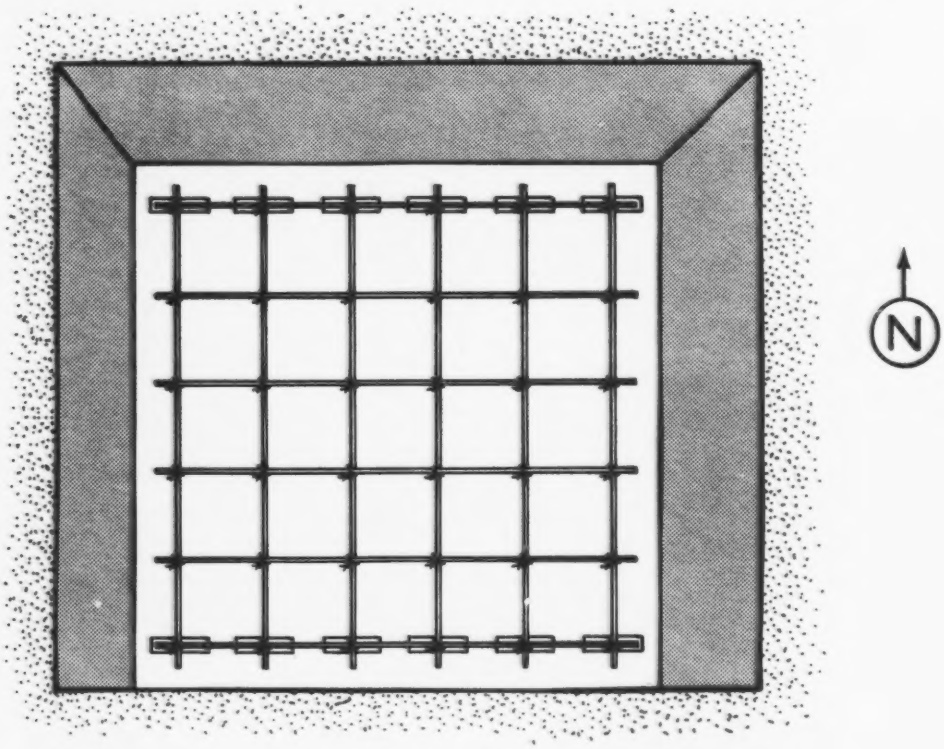
FIGURE 7



JOB SHEET #1

G. Continue this operation until entire reinforcing mat has been tied together (Figure 8).

FIGURE 8



(NOTE: Steel mats in small footings are usually preassembled and then placed after forms are set.)

CONCRETE REINFORCING BASIC SKILLS
UNIT III

JOB SHEET #2 — INSTALL #4 REINFORCING BARS AT 12" ON CENTER IN A WALL 4' X 8' USING WALL TIE

I. Tools and equipment

A. Side cutters, one pair

B. Folding rule or tape

C. Yellow keel, one piece

D. Wire reel and wire

E. Hammer and nails

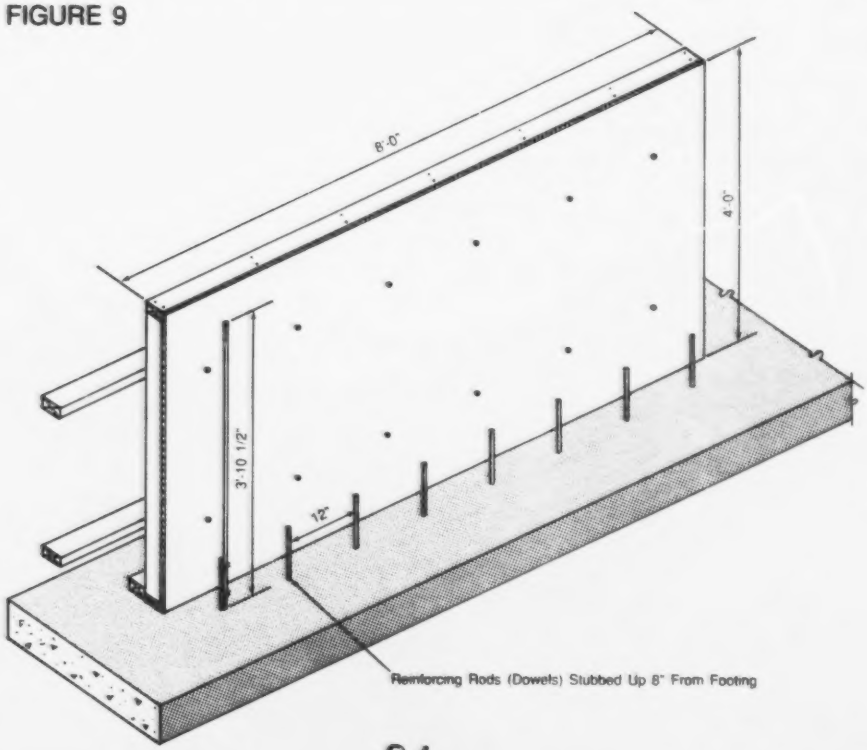
F. Eight #4 rebars 3' - 10 1/2" long

G. Three #4 rebars 7' - 9" long

II. Procedure

A. Stand one short rod against first dowel and tie together (Figure 9).

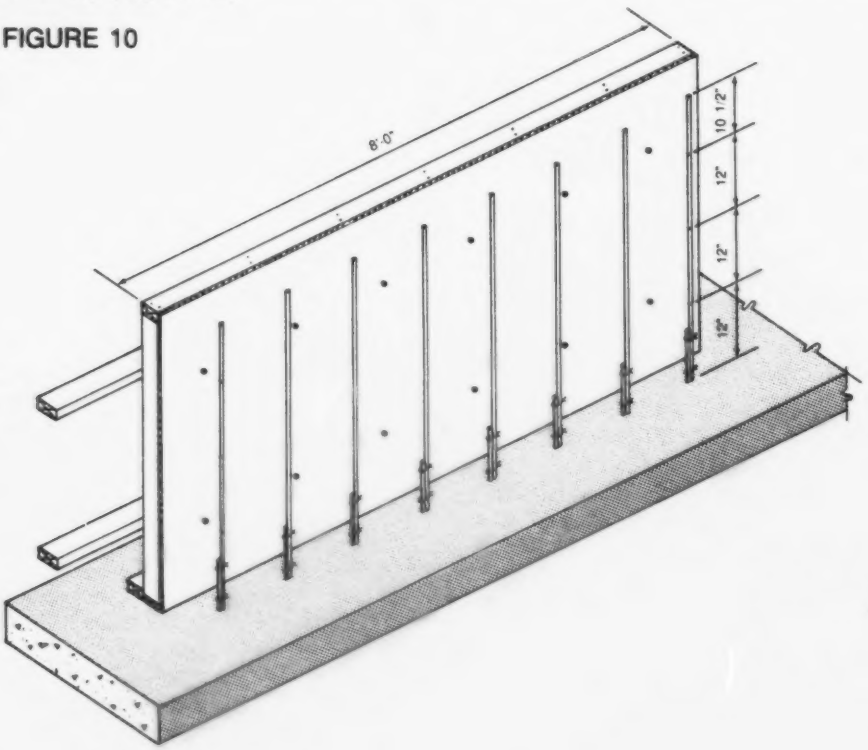
FIGURE 9



JOB SHEET #2

B. Continue this procedure until all of the short rods have been tied and are standing (Figure 10).

FIGURE 10



C. Lay out vertical rods

1. Mark both end rods at twelve inches starting from slab; this will leave only ten and one half inches on the top section (Figure 10). (NOTE: One and one half inches is standard clearance from edge of forms).

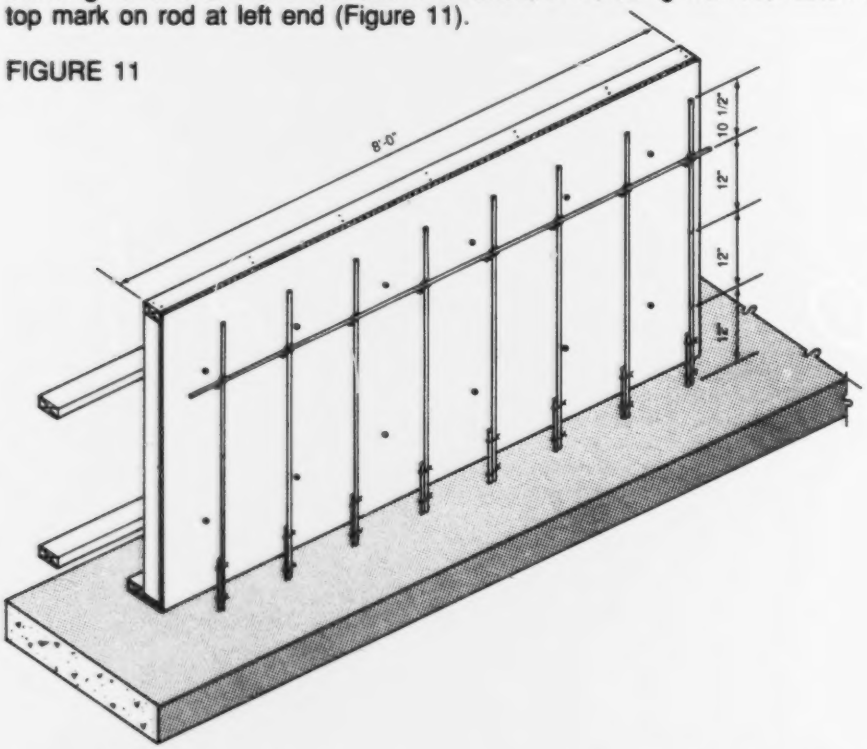
D. Lay out horizontal rods

1. Use rule and keel to measure and mark on first rod starting at four and one half inches from end of rod, make a mark every twelve inches.

JOB SHEET #2

E. Take first rod and temporarily fasten it at top, mark on rod at right end, allowing for one and one half inch clearance; then, using wall tie, fasten rod to top mark on rod at left end (Figure 11).

FIGURE 11



F. Remove temporary tie from right end and, using wall tie, tie two rods together.

(NOTE: Wall tie is made by pulling small amount of wire from reel. Start wire from lower right hand junction of two rods. Push wire through, then out and around top part of short rod, and then back through upper left-hand junction. See Figures 12, 13, and 14.)

FIGURE 12

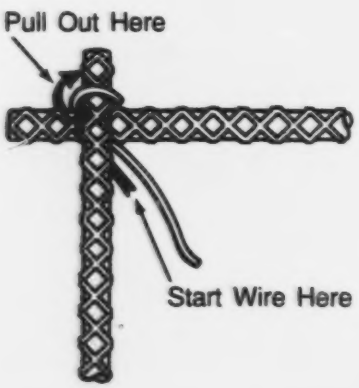
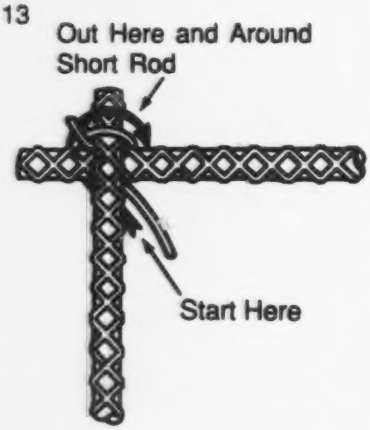


FIGURE 13



JOB SHEET #2

FIGURE 14

G. Grasp both sections of wire with side cutters and twist.

H. Cut off long section of wire and make five or six twists in wire; then cut both ends so there will be approximately three-quarters of an inch left; tap ends down with pliers (Figure 15).

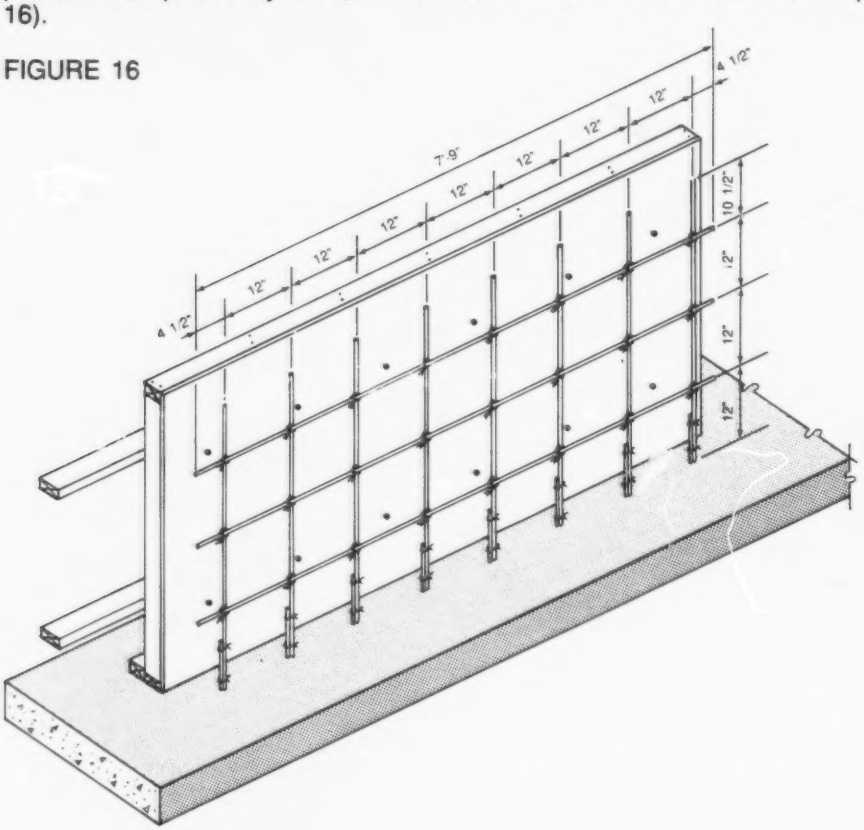
FIGURE 15

I. Continue with same procedure until all ties are made on top rod.

JOB SHEET #2

J. Use rule and keel to measure and mark on second rod twelve inches apart starting at four and one half inches in from end of rod; then using same procedure as previously used, continue to tie all rods until steel is all tied (Figure 16).

FIGURE 16



K. Use hammer and nails to attach bolsters to top section of form behind rods.

CONCRETE REINFORCING BASIC SKILLS
UNIT III

JOB SHEET #3 — LAY AND TIE WELDED WIRE FABRIC

I. Tools and equipment

A. Side cutters, one pair

B. Wire reel and tie wire

C. Bolt cutters, one pair

D. One roll 6 x 6 - W 1.4 x W 1.4 welded wire fabric

II. Procedure

A. Roll out wire fabric to length desired; cut off; to help fabric lay flatter turn it upside down.

CAUTION
To avoid injury be sure to stand on both edges of fabric as you cut the fabric.

B. Turn roll and set next to the first strip of wire fabric.

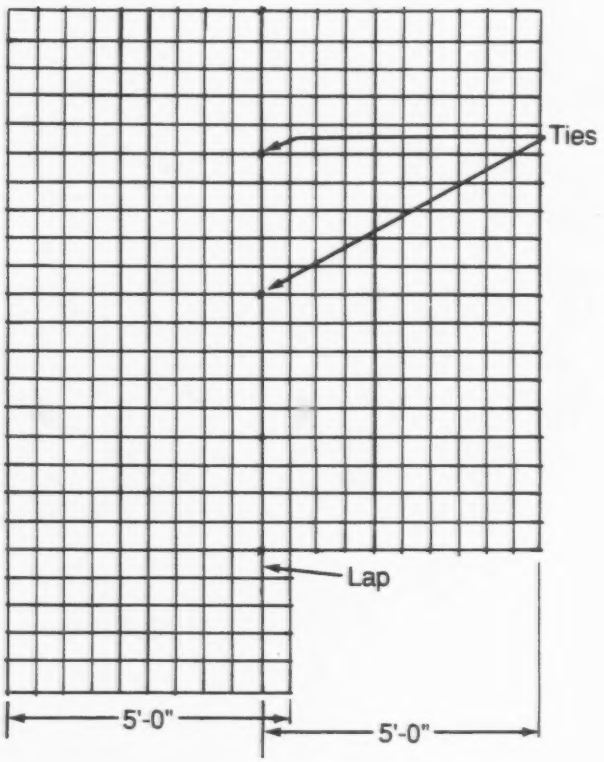
C. Roll out second strip of wire fabric, lapping at least six inches; cut off and turn upside down.

D. Tie edges of wire that are lapped, using simple tie (Figure 17).

JOB SHEET #3

(NOTE: Ties every thirty to thirty-six inches should be sufficient.)

FIGURE 17



CONCRETE REINFORCING BASIC SKILLS
UNIT III

TEST

NAME_____SCORE_____

1. Match terms associated with concrete reinforcing basic skills to their correct definitions. Write the correct numbers in the blanks.

_____a. Steel bars or wires embedded in concrete and located in such a manner that the metal and the concrete act together in resisting loads.

_____b. Reinforcing bars connecting two separately cast sections of concrete.

_____c. Grid of preassembled reinforcing bars.

1. Dowels
2. Matt
3. Reinforcing steel

2. State eight basic skills used in reinforcing operations.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

(NOTE: Test question 3 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

TEST

3. Demonstrate ability to:

   a. Install #4 reinforcing bars at 12" center for footing 6' x 6' using single tie.

   b. Install #4 reinforcing bars at 12" on center in wall 4' x 8' using wall tie.

   c. Lay and tie welded wire fabric.

CONCRETE REINFORCING BASIC SKILLS
UNIT III

ANSWERS TO TEST

1. a. 3
   b. 1
   c. 2

2. Answer should include any eight of the following:

   a. Identify hand tools used in reinforcing work
   b. Ability to use and care for tools properly
   c. Identify equipment related to reinforcing
   d. Identify materials used in concrete reinforcing
   e. Use measuring, leveling, and plumbing devices accurately
   f. Set-up ladders and scaffolds properly
   g. Identify hitches, knots, and accessories used in rigging
   h. Rig and handle different types of loads
   i. Distinguish and give hand signals used in rigging operations
   j. Set up and use a cutting torch
   k. Set up and use a welder
   l. Identify concrete reinforcing symbols and abbreviations found on plans
   m. Make the various types of ties used to secure reinforcing
   n. Install reinforcing bars for footings
   o. Install reinforcing bars in walls, columns, and floor slabs
   p. Lay and tie welded wire fabric

3. Performance skills evaluated to the satisfaction of the instructor.